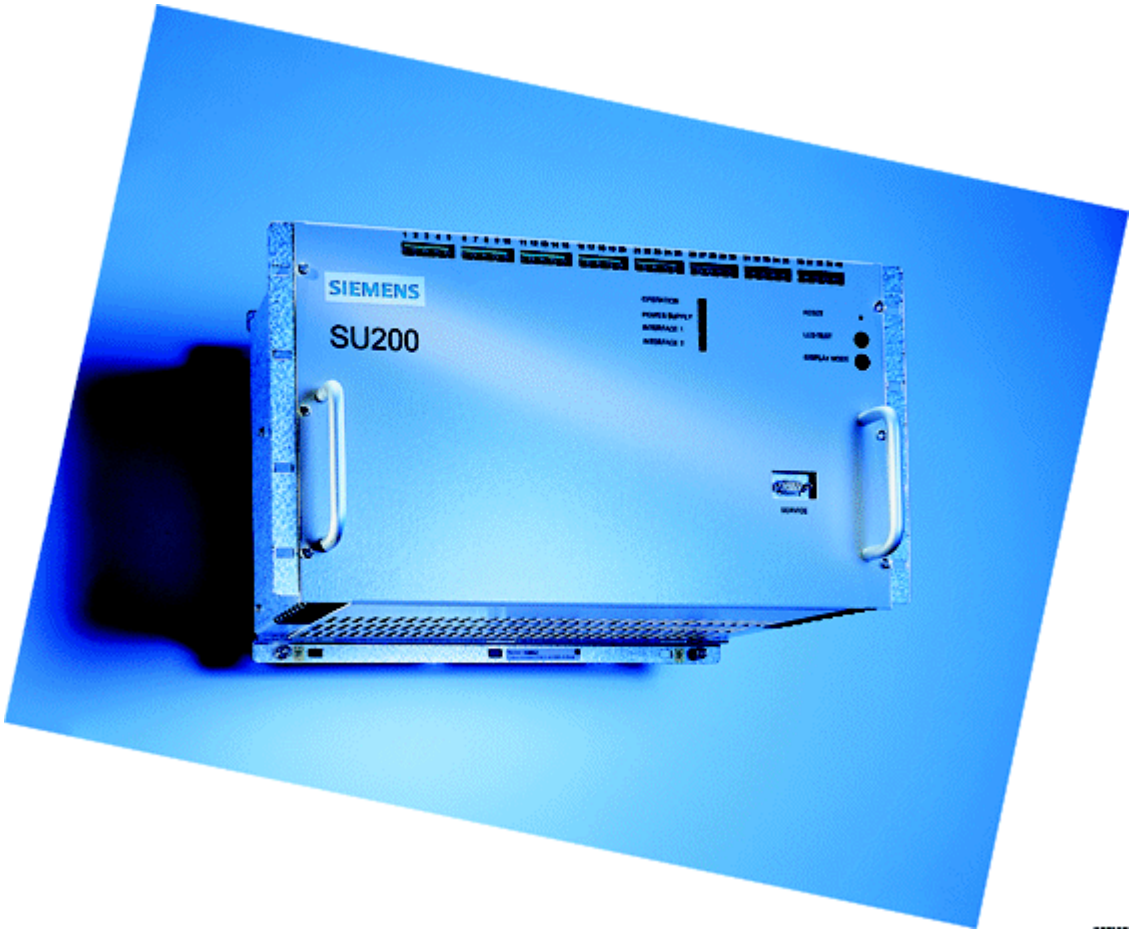
SIEMENS

SU200

Distributed I/O Unit
for MC-based Substation Control Systems

User manual

Order no: LGW : AB03 - Y200A – A



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Version history

Version	*Date*	*Comment*
1	1. Feb 1997	Initial version.
2	15. Sep 1997	Document reformatted. New functionality in SU200DIA V2.13.
3	26. Jan 1998	Encoding of bits used for selecting active/passive master corrected.
4	16. Nov 1999	Rewritten for SU200 software release 3.0
5	08. Jan 2001	New option for 220VAC Relay Output Voltage.
6	30.Aug 2001	Rule file syntax enhanced.
7	22.Nov 2001	Latch programming example for rule file revised
8	14.May 2002	New system message indicating analogue input card faulty. Firmware version 3.10
9	05.Jun 2002	New fail-to-safe configuration and analogue input scaling in SU200DIA described Firmware version 3.40
10	14.Jun 2002	New version of SU200DIA (V 3.50.1)
11	17.Oct 2002	Message 103 is no longer a common message (sent on PROFIBUS)

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1. Introduction

1.1. Application

The task of SU200 is to serve as a decentralised field control device in a microprocessor based station control and monitoring system.

SU200 is developed for data collection, data pre-processing, data transfer and command output at the field control level in medium-voltage and high-voltage substations, power stations and industrial plants.

SU200 is designed to be located in the immediate vicinity of the process with hard-wired parallel interfacing to the various control devices Thus, a distributed intelligence ensures that process data is collected, logged and pre-processed where it is generated.

Communications with the central control station is made via a PROFIBUS fieldbus, which offers interface for both high-speed handling as well as for comprehensive interchange of process data.

The following functions are implemented:

- Acquisition and filtering of binary signals, e.g. from switchgear control and protection units
- Acquisition of analogue values
- Transmission of process data to the central control station
- Reception, conversion and output of relay commands from the central control station
- Time tagging and recording of messages
- Guaranteed data delivery of messages
- Self-monitoring / plausibility checking
- Monitoring of communications links

SU200 is designed to serve as part of a station control and monitoring system.

The functionality of SU200, together with an appropriate fieldbus link and the managing and co-ordinating functionality of a central control station enables the execution of a large number of tasks.

Figure 1 shows how SU200 is incorporated in a structured station control and monitoring system.

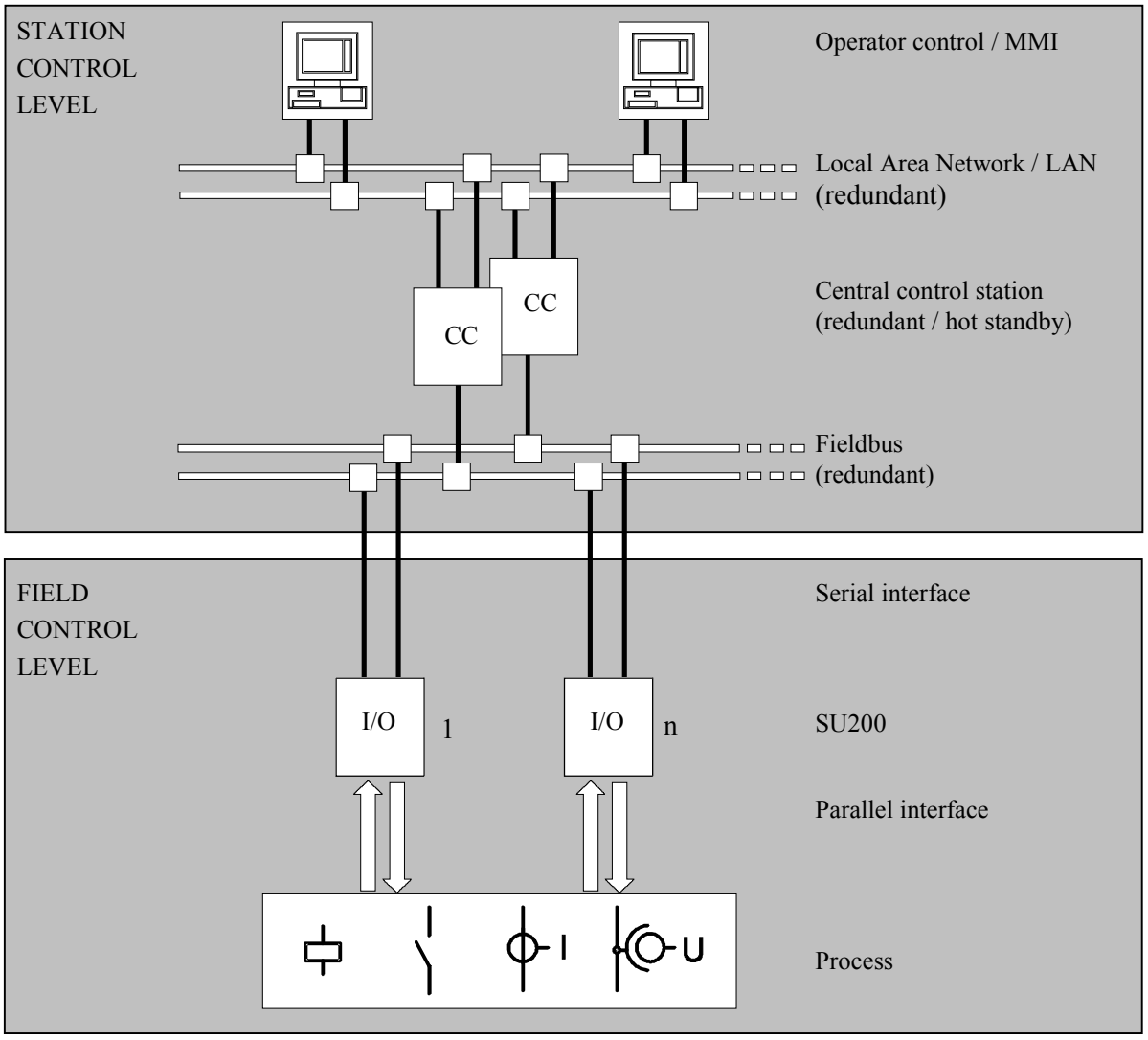

Figure 1 - Principle arrangement of a station control and monitoring system with incorporated SU200

1.2. Features

- Redundant power supply
- Redundant optical communications interface for multi-master configuration, hot standby
- Redundant electrical communications interface for multi-master configuration, hot standby
- Open communications interface according to PROFIBUS DP protocol standard
- Optical and electrical time synchronisation signal input
- Serial interface according to transmission standard V.24 / V.28 for easy parameterisation, diagnostics and local control
- Serial interface according to transmission standard V.24 / V.28 for firmware upgrades and special services
- Real time task scheduling with 1 ms resolution
- Internal HW / SW clock with an accuracy of $\leq 10^{-5}$ (36 ms/hour).
- Message buffer for storage of up to 500 process messages and 50 system messages
- Digital input dead time / filter time: both configurable in the range from 1 ms. to 2500 seconds
- High availability through self-monitoring
- Error-secured output using internal plausibility checking
- Noise protected and isolated input and output circuitry
- High performance verified by way of extensive type tests and field tests (CE conformity)

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- Local display of input / output status
- Indication and signalling of internal faults
- Clear arrangement of controls and indications
- Standardised plug-in connectors for external connection
- Simple installation with the use of a pre-tested and compact unit

Figure 2 shows the general drawing of SU200

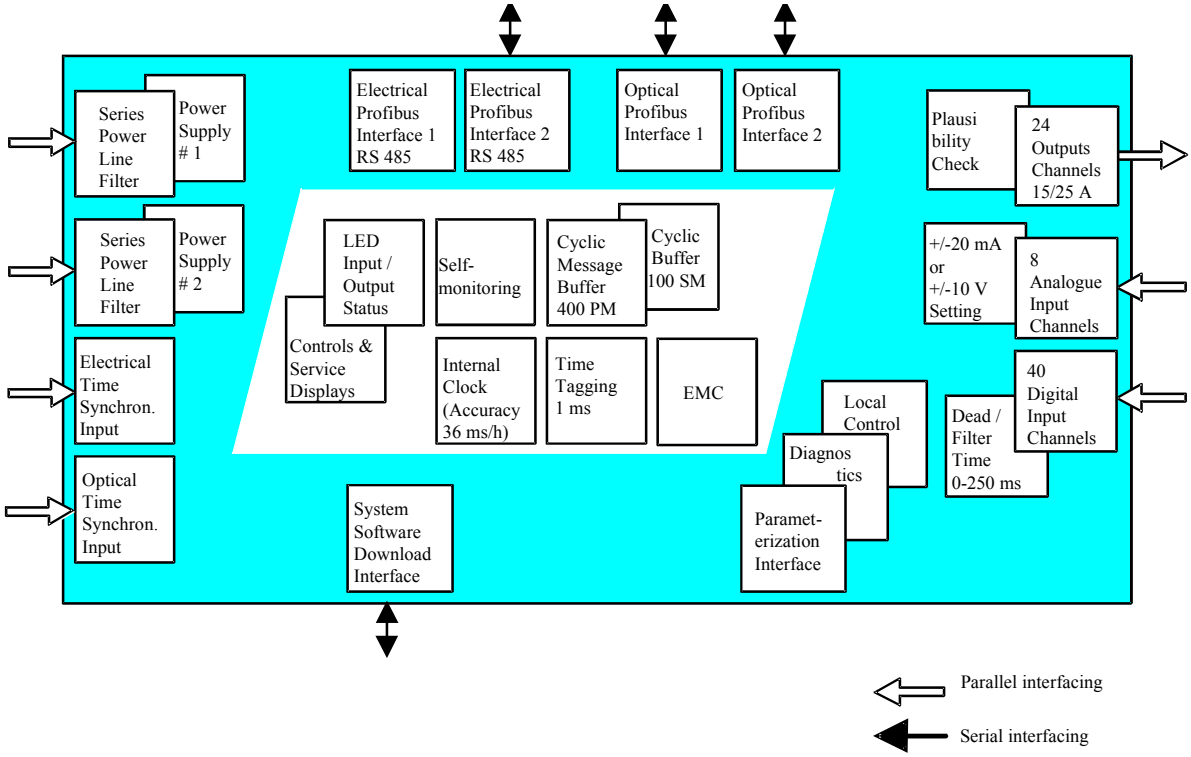

Figure 2 - Overview

1.3. Interfaces

Figure 2 shows all interfaces provided in SU200.

Parallel interfacing to the process (e.g. switchgear) is provided for:

- Power supply
- Switching or initiation of external control devices
- Check-back indication and alarm signalling of external control and switching devices
- Measuring of analogue values
- Time synchronisation of internal clock via electrical trigger signals
- Time synchronisation of internal clock via optical trigger signals

Serial interfaces are provided for:

- Communications with central control station
- Parameterisation, diagnostics and local control
- Downloading of system firmware

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2. Technical data

2.1. General data

2.1.1. Digital inputs

Number of inputs:	40 channels
Rated auxiliary voltage:	Optional DC 24V, 110/125V, 220V
Voltage range:	±20 % of nominal value
Signal level / voltage limits:	L-signal: 0 up to 40 % of nominal value H-signal: 50 up to 120 % of nominal value
Input dead time	1 to 2550 seconds configurable
Input filter time:	1 to 2550 seconds configurable
Power consumption per channel:	≈ 1.1 W (2.5 mA with 220V DC)
Galvanic isolation:	Optocoupler
Connection:	Plug-in connectors, terminal screw 4 mm^2

2.1.2. Relay outputs

Number of outputs:	24 channels / relays, each consisting of 2 NO contacts, with grouped circuits (for common potential) of each 2 channels
Maximum switching voltage:	Option 3: 225VDC / 175VAC, Standard Option 4: 350 VDC / 275 VAC (Ref. Ordering data)
Maximum switching current:	15 A for max. 4 seconds (channels 1 up to 22) 25 A for max. 4 seconds (channels 23 and 24)
Maximum continuous current:	8 A (channels 1 up to 22) 10 A (channels 23 and 24)
Switching capacity (power rating):	Voltage-dependent: 50 - 270 W (output channels 1 up to 22) 35 - 500 W (output channel 23 and 24)
Galvanic isolation:	Relays
Connection:	Plug-in connectors, terminal screw 4 mm^2

2.1.3. Analogue inputs

Number of inputs:	8 channels

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Rated value:	Optional ±20mA or ±10V
Measurement range:	Measuring range is converted into ±200%
Resolution:	12 bits + sign
Linearity of A/D converter:	± 1 bit
Accuracy of A/D converter:	≤ 0.1 %
Measuring error:	≤ 2% of nominal value
Dead time of input filter:	0.8 ms (20 mA input), 50 µF (10 V input)
Power consumption per channel:	20 mW (current input) / 2 mW (voltage input)
Burden per voltage / current path:	50 kΩ (voltage input) / 200 Ω (current input)
Galvanic isolation:	Via series-connected external measuring transducer / transmitter
Connection:	Plug-in connectors, terminal screw 2.5 mm^2

2.1.4. Power supply

Number of supplies:	2 (parallel operation)
Rated voltage:	Optional DC 24V, 110/125V, 220V
Voltage range:	50 % up to 120 % of nominal value
Voltage ripple:	< 10%
Power consumption:	Approx. 16 W (quiescent) Approx. 48 W (50% of input/output activated) Approx. 80 W (100% of input/output activated)
Permissive supply interruption:	100 ms.
EMC:	Series power line filter 115/250 V~, 50/60 Hz, 3 A
Galvanic isolation:	DC / DC-converter
Connection:	Plug-in connectors, terminal screw 4 mm^2

2.1.5. Processors

Central Controller:	1 unit SAF 80C167 / 40 MHz (16 bit processor)
Communication:	2 units SAF 80C165 / 40 MHz (16 bit processor used in 8 bit mode)
Watchdog:	Automatic reset with failure indication

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2.1.6. Time synchronising inputs

Number of optical trigger input:	1
Connection:	Optical fibre bayonet coupling / type ST
Number of electrical trigger input:	1
Signal voltage level:	Optional DC 24 V, 48 V, 110/125 V, 220 V
Voltage range:	±20 % of nominal value
Connection:	Plug-in connectors, terminal screw 4 mm^2
Accuracy of internal clock:	10^{-5} (36 ms/hour)

2.1.7. Fieldbus interfaces for optical transmission media

Transmission speed:	9.6 / 19.2 / 93.75 / 187.5 / 500 / 1500 kBaud (optional 3 / 6 / 9 / 12 MBaud)
Transmission protocol:	Protocol PROFIBUS DP according to EN 50 170 part 3 32 bytes of user data for transmission 12 bytes of user data for receiving
Number of optical ports:	Redundant interface: 4 bus terminals (2 receiver, 2 transmitter)
Connection:	Optical fibre bayonet coupling / type ST
Cable type:	Fibre optic cables with plastic or glass fibres 62.5 / 125 µm
Optical wave length:	820 nm (glass)
Permissive line attenuation:	Max. 8 dB/km
Transmission distance:	Max. 2 km

2.1.8. Fieldbus interfaces for electrical transmission media

Transmission standard:	RS-485
Transmission protocol:	Protocol PROFIBUS DP according to EN 50 170 32 bytes of user data for transmission 12 bytes of user data for receiving
Transmission speed:	9.6 / 19.2 / 93.75 / 187.5 / 500 / 1500 kBaud (optional 3 / 6 / 9 / 12 MBaud)
Number of electrical ports:	2 (redundant)
Connection:	9-pole SUB-D-jack
Cable type:	2-core double shielded cable

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2.1.9. Serial interface for parameterisation and diagnostics

Transmission standard:	V.24 / V.28, RS-232
Transmission speed:	9.6 kBaud
Connection:	9-pole SUB-D-jack
Physical Layer:	Emulated UART
Link Layer:	SIEMENS ST1 Protocol
Hamming Distance:	4

2.1.10. Serial interface for firmware download

Transmission standard:	V.24 / V.28
Transmission speed:	9.6 kBaud
Connection:	9-pole SUB-D-jack
Physical Layer:	UART
Link Layer:	IEC 870 Series 101
Hamming Distance:	4

2.1.11. LED indications

Digital input activated:	Green LED per channel (switch-selectable)
Command output activated:	Green LED per channel (switch-selectable)
Service availability:	Green LED, steady light for healthy operation, blinking light (1s) for malfunction
Power supply:	Green LED, steady light for both power supply units in operation, blinking light for failure of power supply unit 1 (2s) or unit 2 (1s)
Fieldbus communication link 1:	Green LED for healthy operation Blinking light (1s) for transmission blocked
Fieldbus communication link 2:	Green LED for healthy operation Blinking light (1s) for transmission blocked

2.1.12. Electromagnetic compatibility and interference immunity

In accordance with harmonised standard EN 50082-2, 1995 / industrial applications

Conducted HF interference: IEC 1000-4-6 = ENV 50141	Class III 10 V, 150 kHz to 80 MHz
Radiated HF interference, EM-field amplitude-modulated (1kHz): IEC 1000-4-3 = ENV 50140	Class III 10 V/m, 80 to 1000 MHz

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Radiated HF interference, EM-field pulse frequency. Modulated: (200Hz) ENV 50204	Class III 10 V/m, 900 MHz
Fast transients (burst): IEC 1000-4-4	Class IV, 4 kV (power supply) / 2 kV (signal lines), 5/50 ns., 1 min each polarity
Lightning Impulse (surge): IEC 1000-4-5	Class IV ❶, 4 kV, 1.2/50 µs (enclosure) Class III ❶, 2 kV, 1.2/50 µs (DC input ❷) Positive / negative, 1 impulse per min.
Electrostatic discharge / ESD: IEC 1000-4-2	Class IV ❶, 10 positive and negative discharges, 15 kV (peak) contact, 8 kV (peak) air
Radiated power frequency interference / magnet field: IEC 1000-4-8	Class V ❶ 100 A/m continuously 1000 A/m short-time 1 s

❶ Higher severity of test as required per standard
If higher severity is required, an external series filter element is connected

Supplementary

HF disturbance (1 MHz-impulse): IEC 255-22-1	Class III / 2.5 kV (peak) comm. mode / 1 kV diff., 1 MHz, 400 shots/s, duration 2 s

In accordance with harmonised standard EN 50081-2, 1995 / industrial applications

Radio interference/field intensity: EN55011 / CISPR 11	Limit class A

2.1.13. Climatic strain

Permissive ambient temperature - during operation:	-5 to +55°C (recommended values in accordance with Standard EN 60721) -40 to +70°C (values are only guaranteed at appropriate climate conditioning inside weather-protected cubicles)
- during storage:	-25 to +55°C
- during transportation:	-25 to +70°C
Permissive humidity:	Annual average ≤75 % relative humidity. Up to 95 % relative humidity for 30 days a year. Moisture condensation not permissible

2.1.14. Mechanical stress

Earthquake:	during operation: 3 to 35 Hz, ±10 mm amplitude / 1,5 *g* acceleration	
Vibration:	during operation:	10 to 500 Hz, ±0,15 mm amplitude / 2 g acceleration
	during transportation	5 to 500 Hz, ±7,5 mm amplitude / 2 g acceleration
Shock:	during operation:	10 g, 16 ms
	during transportation	15 g, 11 ms

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2.1.15. Dielectric strength

High voltage:	2.5 kV (rms), 50 Hz, 1 min
IEC 255-5	
Insulation resistance:	2 kV DC, 1 min (>100 MΩ)
IEC 255-5	
Impulse voltage:	5 kV (peak), 1.2/50 µs, 0.5 J
IEC 255-4	3 positive and 3 negative shots at 5 s intervals

2.1.16. Equipment design

Dimensions: (width x height x depth)	486 x 298 x 220 mm (see chapter *Dimensions*)
Weight:	approx. 13 kg
Degree of protection:	IP 20

2.1.17. Conformity

This product is in agreement with the requirements of the specification of the applicable council directive in relation to electromagnetic compatibility (publication 89/336/EWG).

This device has been developed and manufactured for service in industrial plants.

This declaration of conformity is based on tests according to harmonised standards EN 50081-2 and EN 50082-2

2.2. Memory capacity

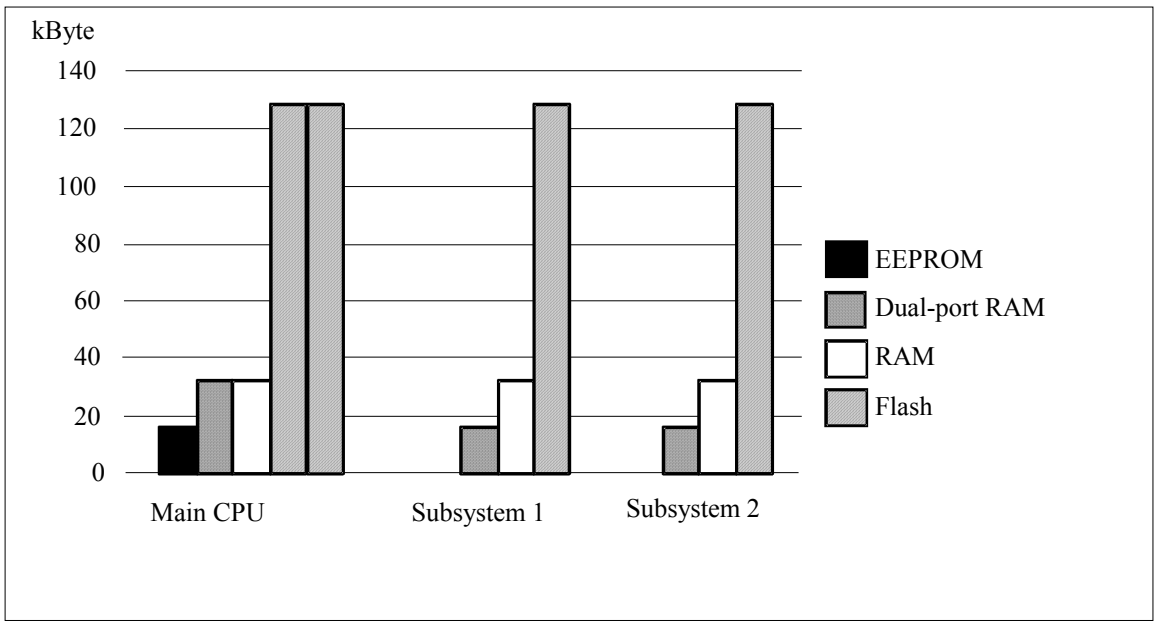

Figure 3 - Memory map

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2.3. Ordering data

SU200 can be supplied in 6 versions, dependent on the power supply voltage and digital input voltage.
2 options are possible depending on the maximum Relay Output Voltage.
The analogue input module is standard.

Designation		Ordering number		Remark
Distributed Input/Output unit SU200		**LGW: AB03-A101 □-A-**	**□**	**/ AA**
Power supply: 220V DC	Digital Input: 220 V DC	**A**	⇑	
Power supply: 110 / 125V DC	Digital Input: 110 / 125 V DC	**B**	⇑	
Power supply: 24V DC	Digital Input: 24 V DC	**C**	⇑	
Power supply: 110 / 125V DC	Digital Input: 24 V DC	**G**	⇑	
Power supply: 220 V DC	Digital Input: 110 / 125 V DC	**H**	⇑	
Power supply: 220 V DC	Digital Input: 24 V DC	**J**	⇑	
			⇑	
Option:	~~With analogue input module~~		~~1~~	Obsolete
	~~Without analogue input module~~		~~2~~	Obsolete
	Maximum Relay output Voltage 225VDC/175VAC		3	Standard
	Maximum Relay output Voltage 350VDC/275VAC		4	

Diagnostic/ Parameterisation Software	**LGW : AB03 - Y100A - A**	
Complete documentation	**LGW : AB03 - Y200A - A**	

Accessories:

Bus connector (PROFIBUS) 45° cable outgoing	**Ref. Simatic Accessories**	
Bus connector (PROFIBUS) 90° cable outgoing	**Ref. Simatic Accessories**	
Bus connector (PROFIBUS) axial outgoing	**Ref. Simatic Accessories**	
Optical link module (PROFIBUS OLM)	**Ref. Simatic Accessories**	
Plug-in connector (PHOENIX) 9-pole for binary input	**18 04 97 5**	PC 4/9-ST-7,62
Plug-in connector (PHOENIX) 6-pole for command output	**18 04 94 6**	PC 4/6-ST-7,62
Plug-in connector (PHOENIX) 6-pole for analogue input	**17 57 05 1**	MSTB 2,5/ 6-ST-5,08
External protective m.c.b. for SU200 auxiliary supply circuitry	**5 SX5 201-7**	110 V-220 VDC
	5 SX2 202-7 (5 SX2 102-7)	24 VDC
	5 SX9 100	1NO,1NC aux. contact

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2.4. Block diagram

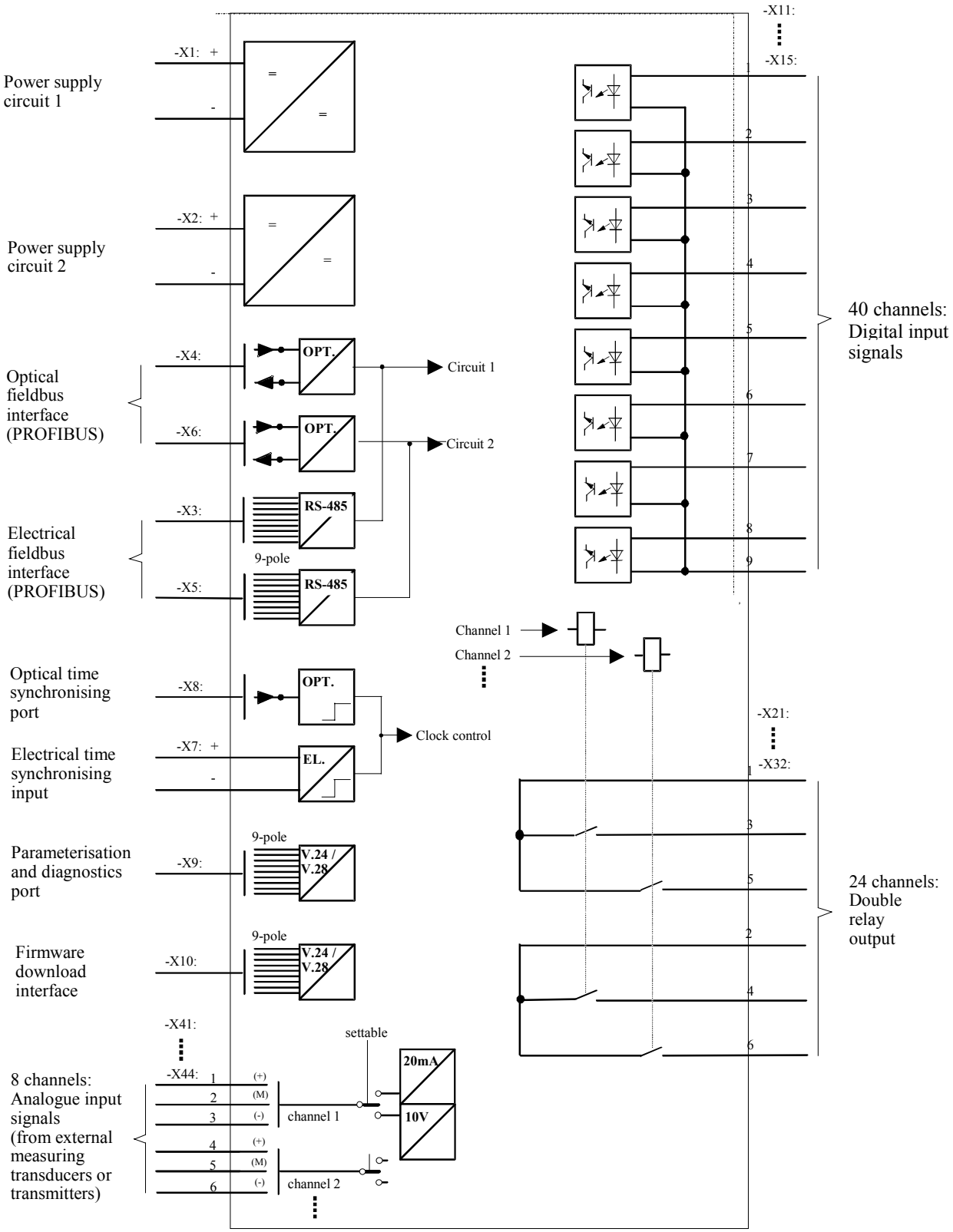

Figure 4 - Block diagram

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3. Design

3.1. Construction

SU200 is made as an enclosed compact device in an IP20 metal housing and is designed for surface mounting on standard subrack frames or for cubicle mounting.

SU200 contains the following components:

- Power supply modules
- Processors and communications module
- LED module
- Relay output module
- Digital input module
- Analogue input module

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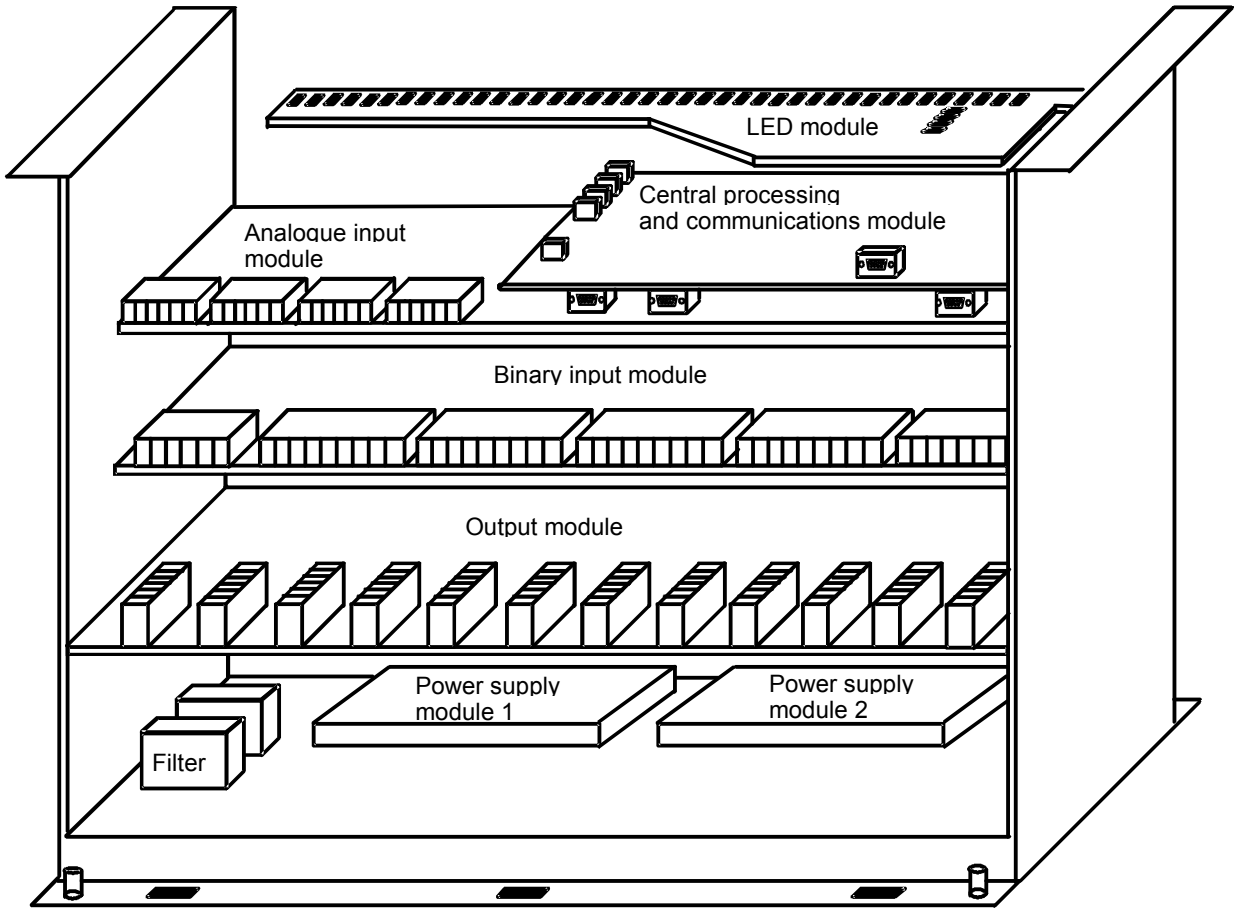

Figure 5 - Modular arrangement of SU200

3.2. Modules

3.2.1. Power supply module

The power supply of SU200 is arranged with two independent modules forming a redundant system. The internal auxiliary voltages for the individual modules of SU200 are provided in a switch mode solution and distributed by way of ribbon cable connections.

For the connection of the external power supply, 4 mm^2 plug-in connectors are provided on the input module.

The external power supply is fed through series power line filters in order to increase the interference immunity / EMC.

The device can be supplied in three versions, whereas the rated power supply can be 24 V, 110/125 V or 220 V DC.

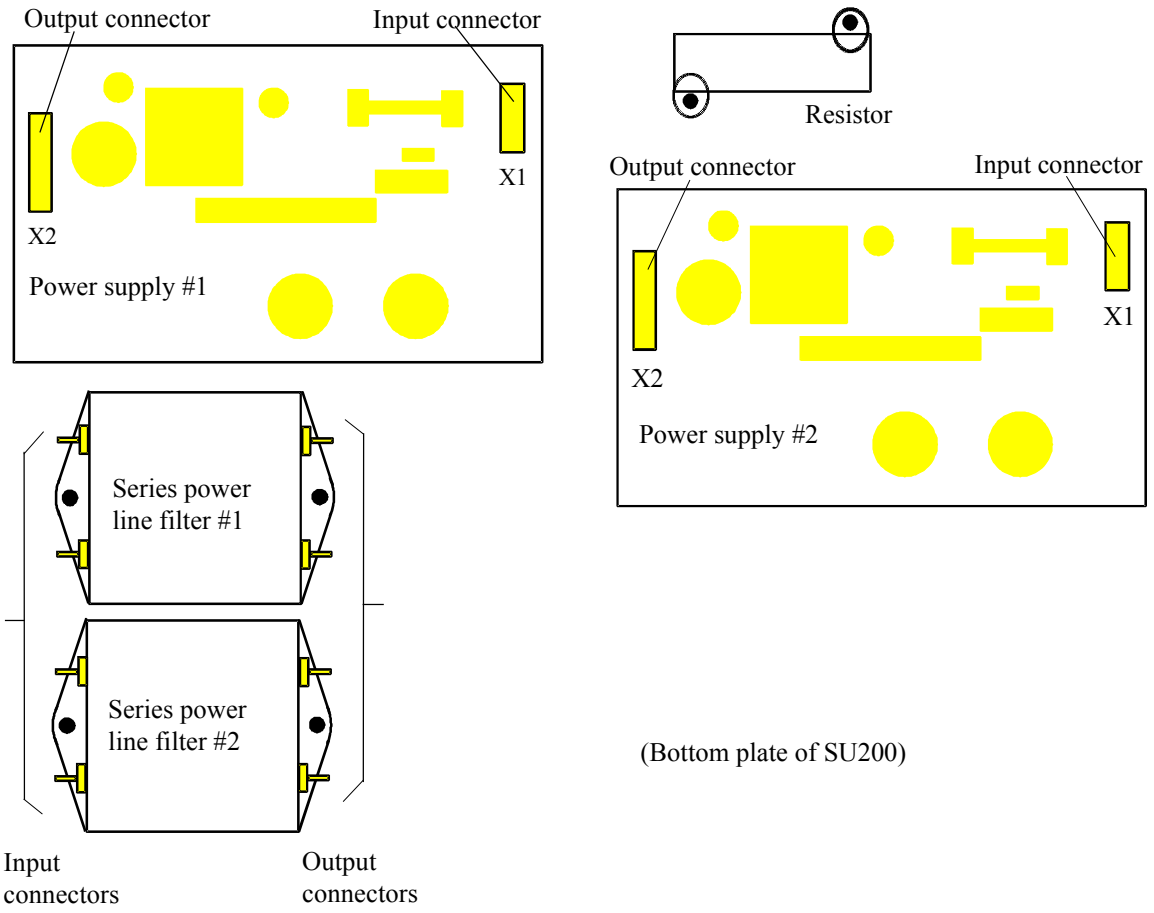

Figure 6 - Layout of power supplies modules

3.2.2. CPU and communications module

The central processor unit (CPU) is responsible for pre-processing of acquired process data and organising of the data exchange with the central control station.

The microprocessor carries out a full restart on power-up and reset.

For communications with the central control station, a redundant interface for both electrical and optical data transmission media is provided.

For the connection of a redundant fibre optic fieldbus link, four bus terminals with bayonet coupling (ST standard ports) are provided, consisting of two receiver and two transmitter ports designed to operate with 62.5/125 µm fibre optic cables.

The receiver incorporates an integrated photo IC containing a photo-detector and dc amplifier driving an open-collector output transistor.

The transmitter contains an 820 nm emitter capable of efficiently launching optical power into four different optical fibre sizes.

The receivers are easily identified by their dark grey colour; transmitters are made in light grey colour.

In addition, 2 SUB-D jacks are provided on the CPU for the connection of a redundant electrical fieldbus link.

For the open communications, the protocol PROFIBUS-DP as defined by EN 50 170, part 3 is selected.

The fieldbus interface is arranged with subsystems containing a standard PROFIBUS-DP controller and a processor, which communicates with the main CPU via dualport RAM.

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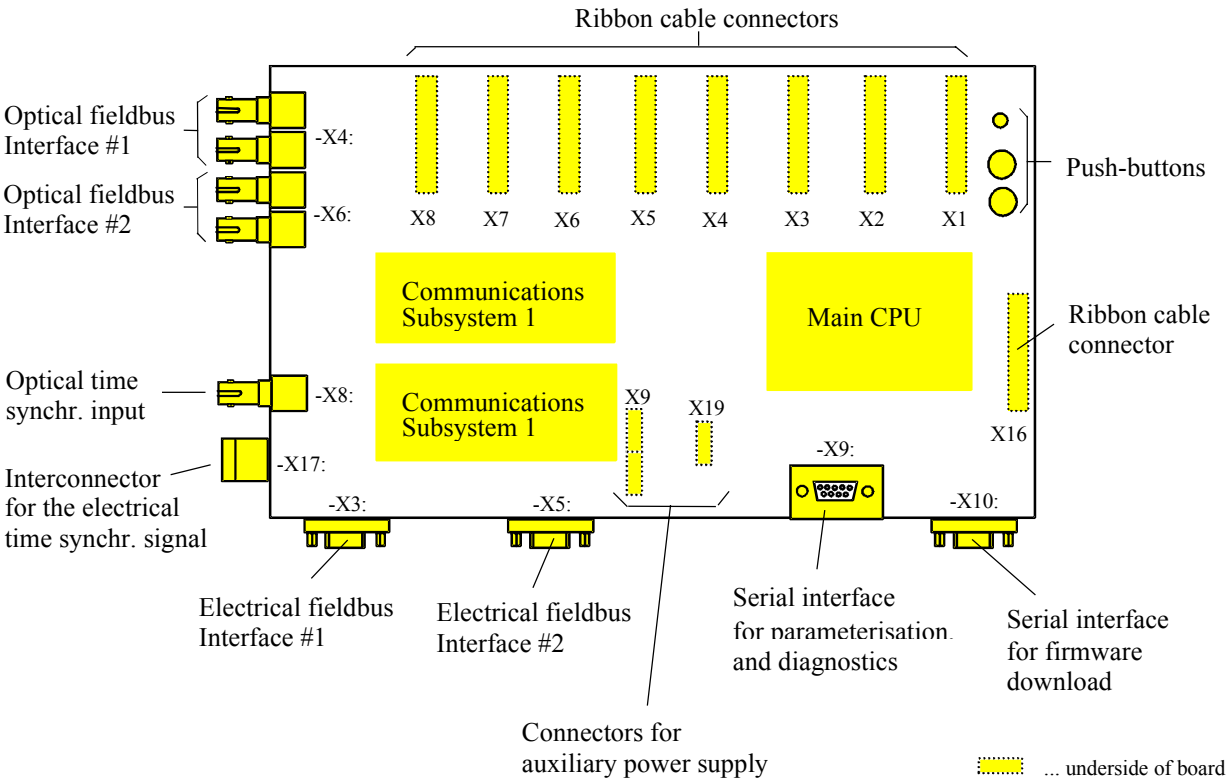

Figure 7 - Layout of CPU and communications module

The module is equipped with the following interfaces:

- Optical interface for fieldbus #1
- Optical interface for fieldbus #2
- Electrical interface for fieldbus #1
- Electrical interface for fieldbus #2
- Optical time synchronisation signal input
- Serial interface for parameterisation and diagnostics
- Serial interface for download of firmware

Pushbuttons are provided for:

PUSH button	Action
RESET	Initiates a hardware reset
LED-TEST	Initiates a firmware test and indicates proper function of the LED's
DISPLAY MODE	Initiates a change-over between LED display of digital input and relay output

3.2.3. LED module

The LED module is attached to the CPU module via spacer sleeves and contains

- 40 LED's to provide status indication of either the input or the output channels. The *DISPLAY MODE* pushbutton can be used to toggle between indication of the input status or the output status.

- 1 LED named *OPERATION* to provide status indication of the operating condition and service availability of the CPU. Steady light indicate healthy operation, blinking light indicates malfunction

- 1 LED named *POWER SUPPLY* to provide status indication of both power supply units. Steady light indicate healthy operation, blinking light indicates malfunction

- 2 LED named *INTERFACE 1* and *INTERFACE 2* provides status indication of the operating condition of both communications interfaces. Steady light indicate healthy operation, dark LED indicates communications out of service

The interconnection to the CPU module is made via two ribbon cables.

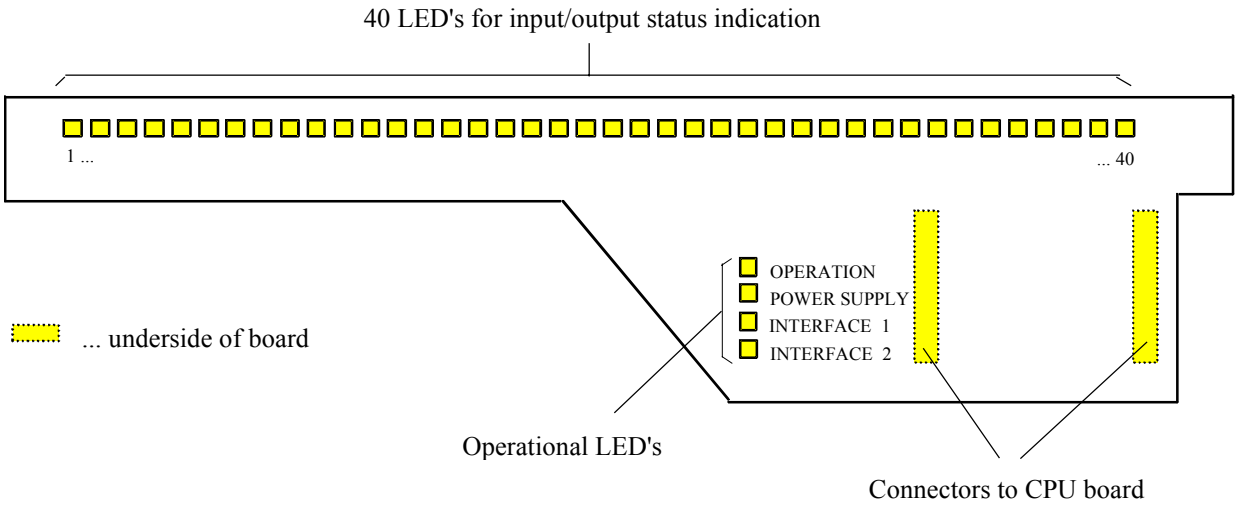

Figure 8 - Layout of LED module

3.2.4. Relay output module

The relay output module is arranged with 24 noise protected and isolated double-command outputs.

The interconnection to the CPU module is made with four ribbon cables. For the external connection, 4 mm^2 plug-in connectors are provided.

The maximum switching current of 22 output channels is 15 A (4 s), 2 output channels are designed for a maximum switching current of 25 A (4 s).

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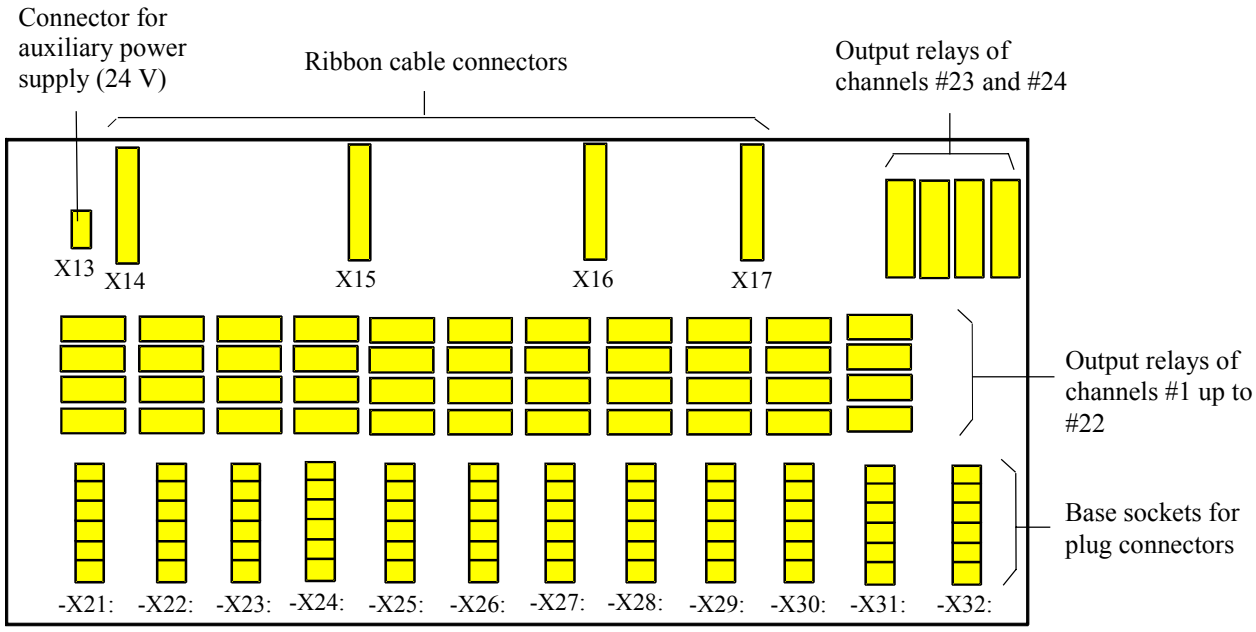

Figure 9 - Layout of relay output module

3.2.4.1. Relay output monitoring

All relay output channels are monitored for correct command output.

By way of feedback circuits, the output of an individual channel is only released after a plausibility check has been executed and the output circuitry is considered as healthy.

In case of malfunction, the respective output group (two channels) is blocked and a corresponding system message is sent to the central control station.

3.2.4.2. Relay output circuitry

Each relay output channel is provided with two NO (normal open) contacts.

The output channels are organised by groups of two channels. Two output channels are connected to common paths and enable, on one hand, double-pole switching and, on the other hand, switching in both directions (e.g. closing and opening of an external control/switching device).

Figure 10 shows the general output arrangement and a typical connection of a high voltage switching device.

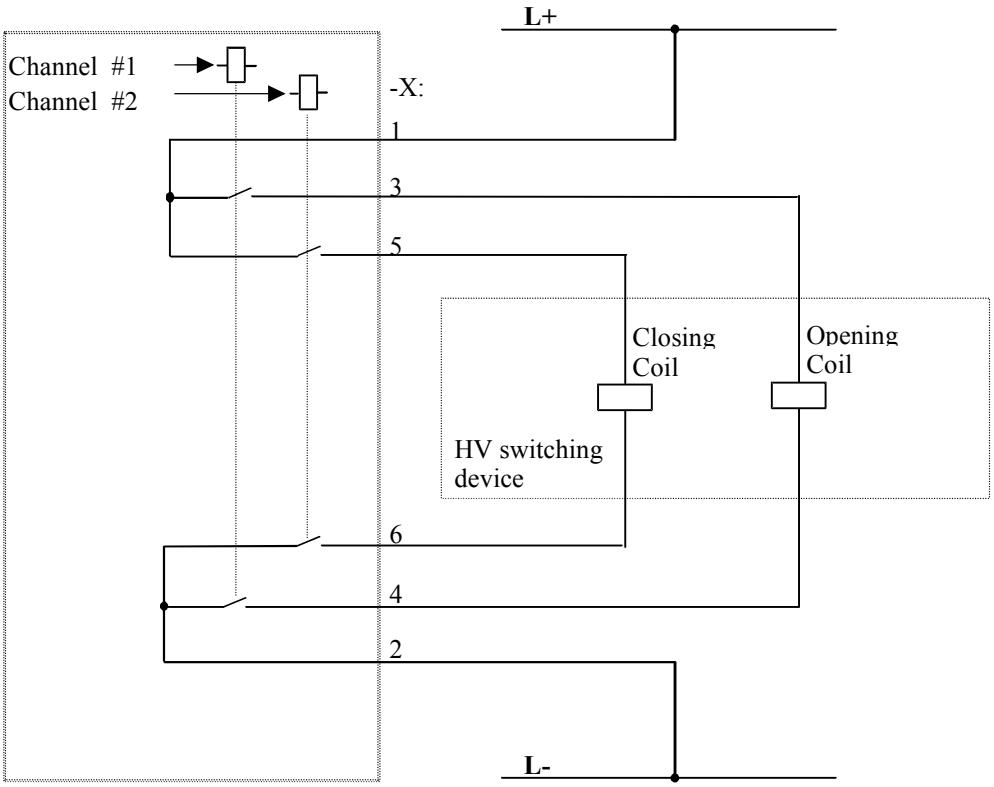

Figure 10 - Output circuitry

3.2.5. Digital input module

The input module contains 40 noise protected and optical isolated digital input channels and can be supplied in three versions for external signal voltage 24 V, 110/125 V and 220 VDC.

The interconnection to the CPU module is made with two ribbon cables. For the external connection, 4 mm^2 plug-in connectors are provided.

The input circuitry is provided in a grouped form. A group of eight digital input channels are connected to one common path.

In addition, the electrical time synchronisation input and the two power supply inputs are provided on the input module.

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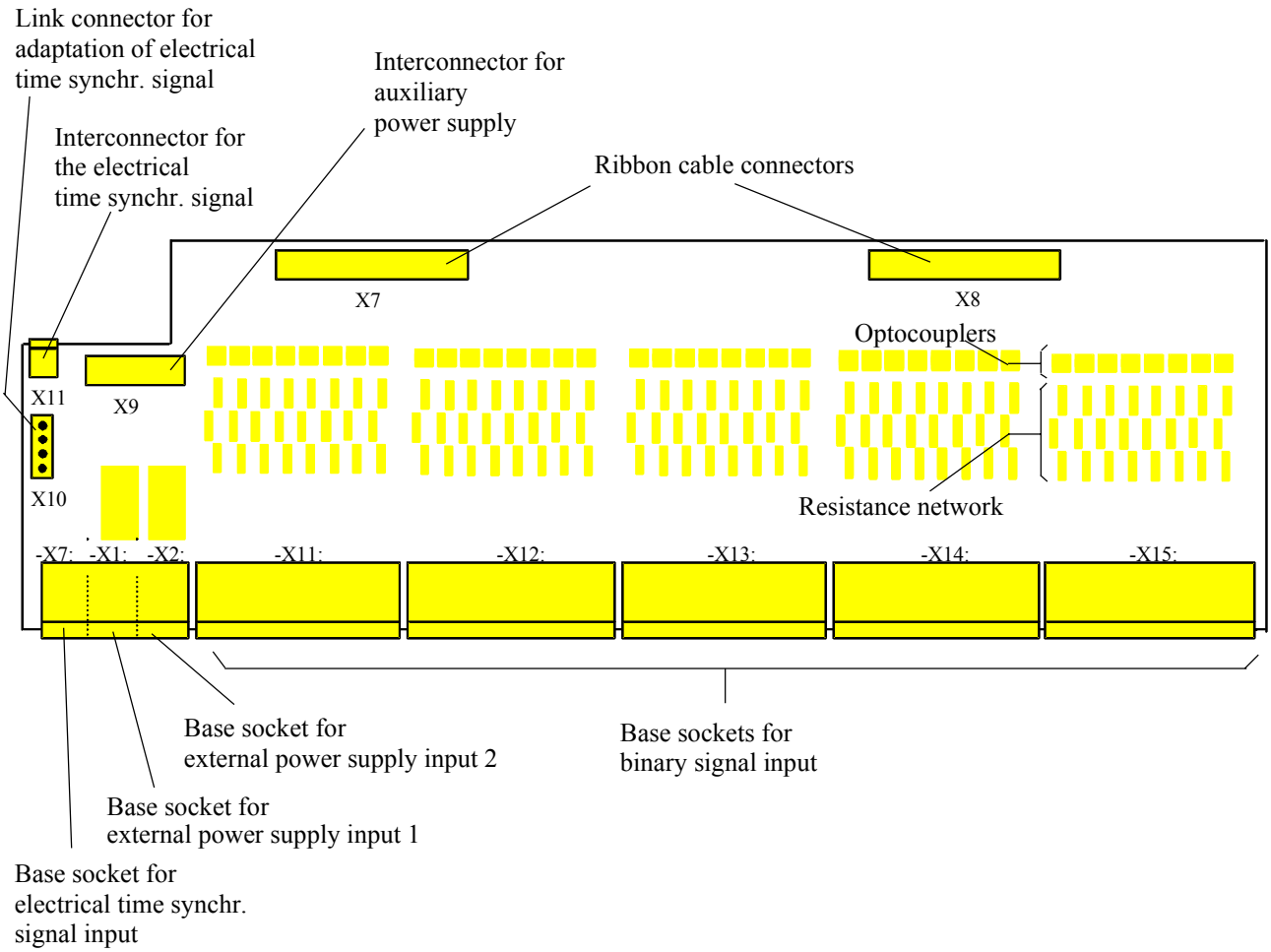

Figure 11 - Layout of digital input module

3.2.5.1. Electrical time synchronisation port

The time synchronisation input can be adapted to four different voltage values by way of changing a link / jumper on connector -X10.

Signal voltage	*Pin configuration on connector -X10*
220 VDC	No straps
110 VDC	Strap 1-2
48 VDC	Strap 1-3
24 VDC	Strap 1-4

3.2.6. Analogue input module

SU200 can be optionally equipped with an analogue input module providing 8 analogue input channels.

The analogue input can be set for ±10V or ±20mA input rating and is therefore designed to acquire measured values of external measuring transmitters or transducers with ±10V or ±20mA output rating.

The interconnection to the CPU module is made with one ribbon cable. For the external connection, 2.5 mm^2 plug-in connectors are provided.

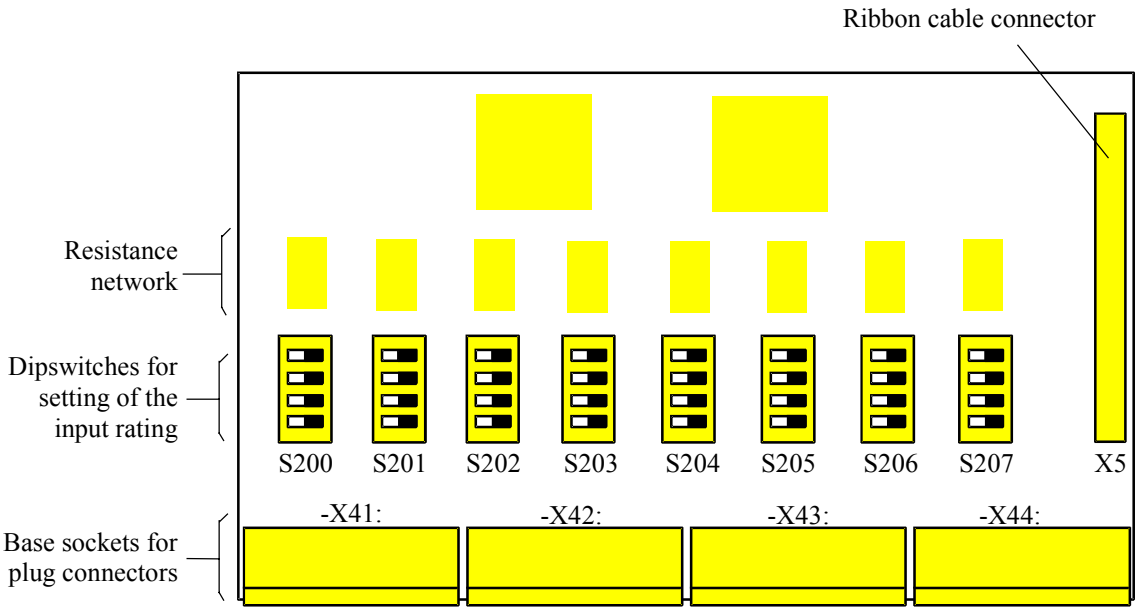

Figure 12 - Layout of analogue input module

Each channel of the analogue measuring input can be configured individually as ±10V input or ±20mA input.

The setting is done via a DIP switch provided for each channel.

Figure 13 shows the appropriate combinations.

Figure 13 - DIP switches for type of analogue input signal

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3.3. Dimensions

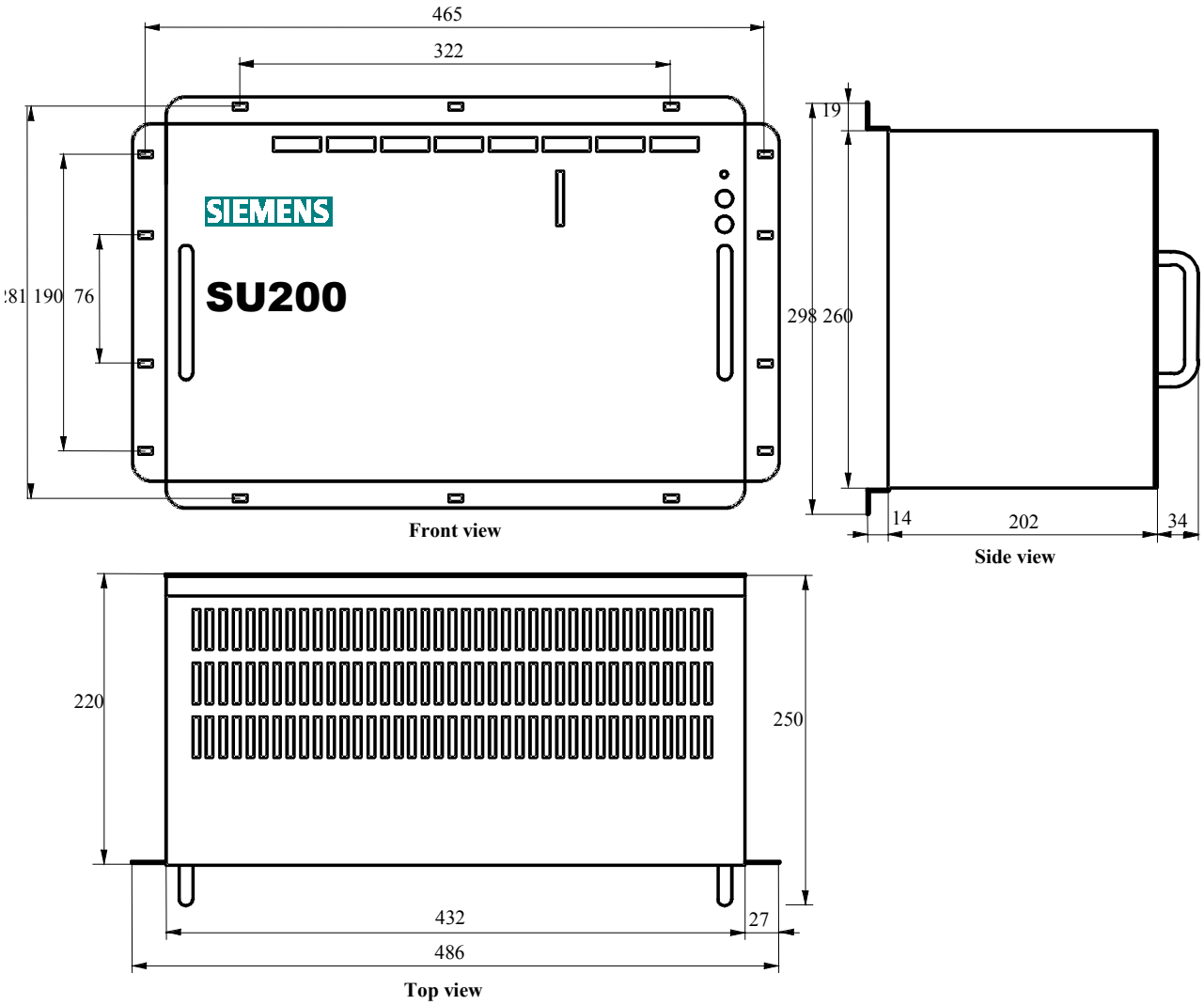

Figure 14 - Dimensions

3.4. Connections

The connection of the external wires is done by way of standard plug-in connectors, consisting of plug connectors and base sockets, which are fixed on the respective board.

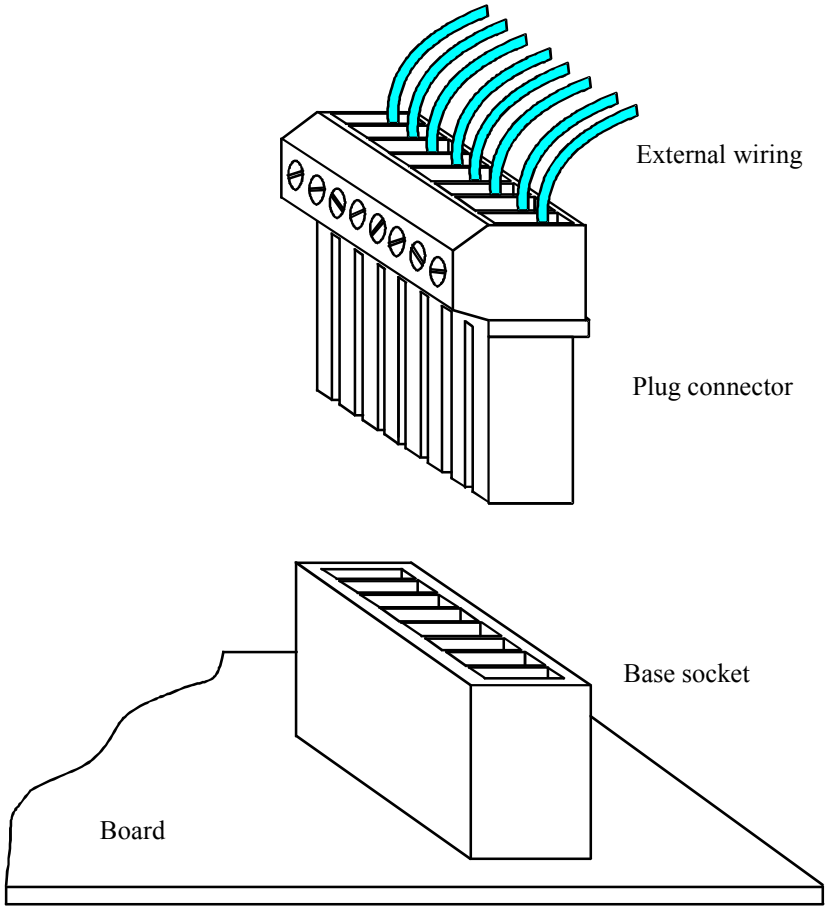

Figure 15 - Plug-and-socket connection of external wiring

The signal input is arranged with 9-pole plugs, for command output 6-pole plugs are provided. Thus, exchange of plug connectors by mistake is prevented.

All plugs for digital input and output are designed with 4 mm^2 screw terminals. For the analogue input, 6-pole plug connectors with 2.5 mm^2 screw terminals are provided.

Figure 16 shows the various plug connector versions with the associated internal circuitry.

SU200 User manual

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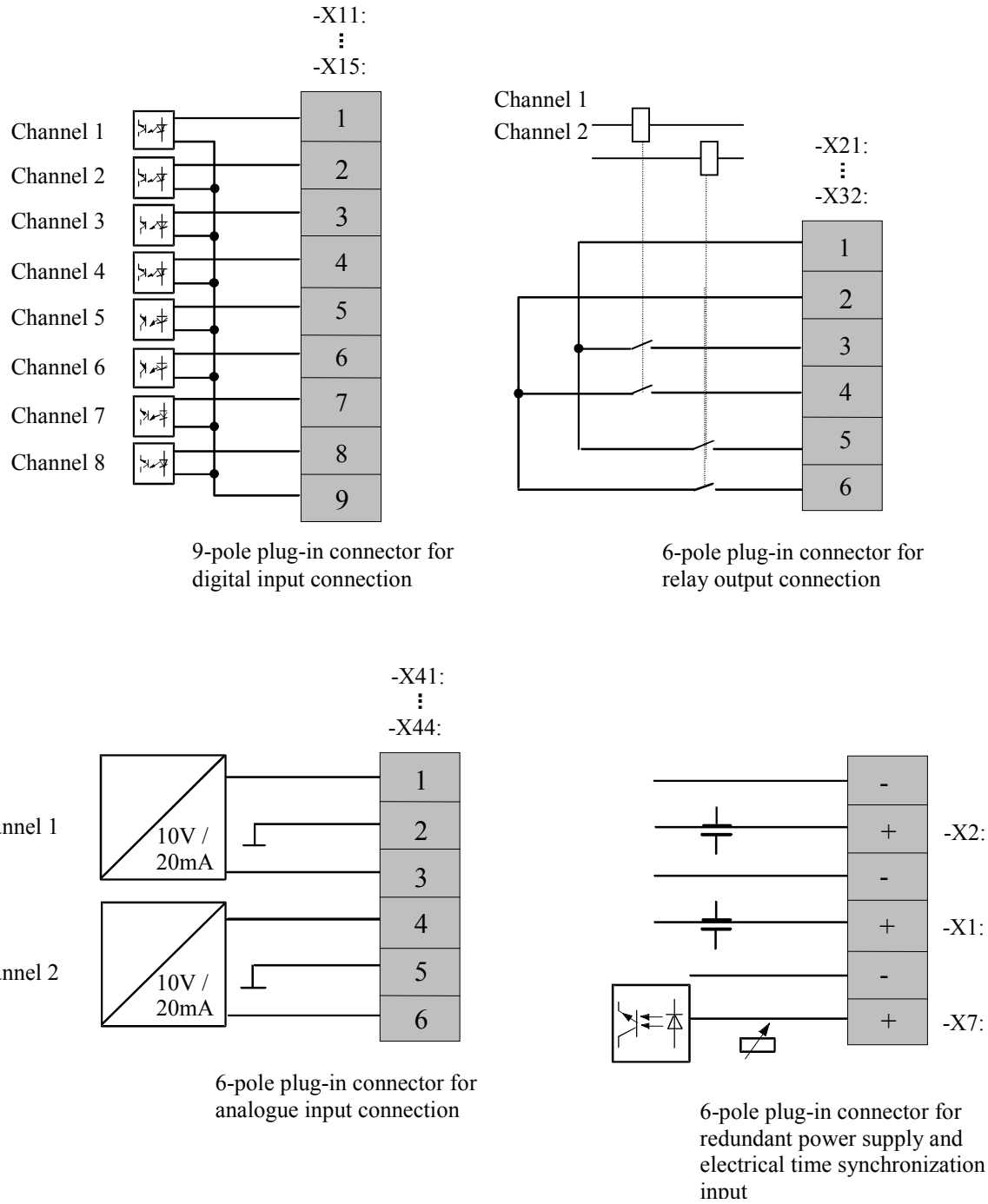

Figure 16 - Types of connecting plugs with internal circuitry

4. Method of operation

4.1. Operation principle

SU200 is equipped with powerful 16 bit microprocessors. This provides fully digital pre-processing of process data.

Process data are acquired at the field level via the digital and analogue inputs of SU200. The values are formatted into telegrams and transmitted via a fieldbus link to the central control station.

Each recognised status change of the digital inputs is converted into a process message, marked with date and time with 1 ms. resolution, and written into a message buffer. These time-tagged process messages are together with analogue values passed on to the central control station.

Control commands from the central control station are converted and provided in parallel form at the output circuitry of SU200.

Each of the relay output channels is arranged with a feedback control circuit in order to monitor correct command output.

4.2. Self-monitoring

All hardware and firmware functions of SU200 are continuously monitored by way of plausibility checks. If irregularities are detected in hardware or firmware, a system message marked with date and time is written into the message buffer.

The time-tagged system messages are immediately transmitted to the central control station as a common system message.

Figure 20 shows the individual single system messages and the combination into the respective common system message, which is then transmitted to the central control station. All single system messages can however be read from the message buffer using SU200DIA application

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Local message	*Description*	*Logic to common message*	*Common message*	*Description*
S-101	Unit start-up	=	S-141	Unit start-up
S-102	Time synchronising trigger signal missing			
S-104	Power supply #1 failure	≥	S-142	Device disturbed
S-105	Power supply #2 failure			
S-114	Power supply #1 healthy	&	S-143	Device disturbance cleared
S-115	Power supply #2 healthy			
S-116	Time synchronising trigger signal received			
S-106	CPU-RAM failure			
S-107	EEPROM failure			
S-108	Watchdog failure	≥	S-144	Device faulty
S-109	Communications interface #1 internal failure			
S-110	Communications interface #2 internal failure			
S-113	Analogue input card faulty.			
S-117	Special function: Programmable interlocking rule program checksum failure			
S-118	FLASH memory write failure			
S-1…S-12	Output group 1…12 faulty			
S-146	Local control mode actuated	=	S-146	Local control mode actuated
S-147	Remote control mode actuated	=	S-147	Remote control mode actuated
S-103	Message buffer overflow		-	500 unsent messages stored. No transmission to higher control level
S-111 ①	Communications interface #1 out of service		-	No transmission to higher control level
S-112 ①	Communications interface #2 out of service		-	No transmission to higher control level

Table 1 - System messages generated by the self-monitoring facility

① If single master mode is programmed, system message S-111 respectively S-112 is not generated if the second communications channel is out of service.

4.3. Redundancy

SU200 is designed for fieldbus communications in single master or dual master configuration, whereas single master configuration may be utilised via any of the two interfaces.

The redundant communications interface enables SU200 to be integrated in a station control system in hot standby mode.

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A hot standby configuration at the higher station control level is achieved with an active and a passive central control station (master), representing a two-channel configuration with a dynamic 1-out-of-2 redundancy. Both central control stations run in a parallel mode, each with a full update of the process image at any time.

If a hardware or firmware error is detected in the active central control station, immediate and bumpless transfer to the hot standby (passive central control station) is executed by means of an automatic switchover system and the hot standby becomes active control unit.

The switchover between master and hot standby is executed without any loss of information and the process is kept going.

SU200 is designed to accept and process orders received from the active central control station only. If SU200 recognises a switchover of the two central control stations via a specific bit pattern in the received telegrams, the actual output commands are frozen for 3 seconds.

After 3 seconds, new output orders from the central control station are accepted by SU200 only if one single active central control station is recognised, in all other cases the command output is reset (command ending).

4.4. Data transfer

4.4.1. Fieldbus

SU200 is designed for data interchange between station and field control level via a fieldbus.

For the open communications between the central control station (master) at the higher station control level and SU200 at the field control level, the PROFIBUS fieldbus is used.

PROFIBUS defines the technical and functional characteristics of a fieldbus and provides for extremely fast handling as well as comprehensive interchange of process data.

PROFIBUS offers an extensive range of network components for electrical and optical transmission and combines simple installation and service, good diagnostic facilities and an error-free transmission in an optimal manner.

4.4.2. Network configuration

With the use of star couplers, repeaters and/or optical link modules (OLM‘s) and optical link plugs (OLP‘s), the PROFIBUS network can be configured individually in a in-line, ring or star topology and allows the linking of two-wire (copper) and fibre optic transmission media.

4.4.3. Principle of operation

Data exchange on the PROFIBUS fieldbus runs in a programmed cycle using the principle of a master-slave system as specified in European Norm EN 50 170.

Masters only may initiate requests for data, slaves may only respond to this requests.

4.4.4. Transmission media

SU200 is equipped with two ports for connection of an electrical transmission media and another two ports for connection of an optical transmission media (redundant interface). Only one of the two communications interfaces (electrical or optical) of SU200 can be in service at any time.

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4.4.5. Electrical transmission media

- The electrical PROFIBUS fieldbus is arranged with 2-core (twisted pair) double-shielded cable.
- Transmission standard RS 485 is utilised.
- The RS 485 interface operates on voltage differences and is therefore less sensitive to interference than a voltage or current interface.
- The maximum number of nodes of an electrical fieldbus is 32 per segment.
- By means of repeaters a two-wire network can be extended to 127 nodes.
- SU200 is suitable for transmission speed of up to 1.5 MBaud. In particular cases, transmission speed of up to 12 MBaud is possible.

4.4.6. Optical transmission media

The fibre optic network is set up with duplex fibre optic cables (glass or plastic) and is insensitive to electromagnetic interference.

FO cables serve to transmit signals by means of electromagnetic waves in the region of optical frequencies. SU200 transmitter and receiver are suitable for transmission speed of up to 5 MBaud.

For communications between bus nodes, there is no discernible difference between the two-wire and fibre optic technology.

4.5. Telegram structure

4.5.1. From SU200 to Master

For the data transmission from SU200 to the central control station (master), the telegram is structured with 32 bytes of user data.

SU200 will automatically switch between transmission of various types of telegrams:

AI enabled *(and not faulty)*	*kWh counter*	*Transmission of messages*
No	No	Process- and system-messages are transmitted once they are generated. After acknowledgement from the master, SU200 will repeat transmitting the telegram until a new process- or system-message is generated.
No	Yes	If there are no process- or system-messages to transmit, SU200 will transmit kWh counter values continuously. When a new process- or system-message is generated, SU200 will continuously transmit the system/process-message until it's acknowledged, thus while waiting for acknowledgement, kWh counter values are not transmitted.
Yes	No	If there are no process- or system-messages to transmit, SU200 will transmit analogue values continuously. When a new process- or system-message is generated, SU200 will transmit this message for 2 out of 3 times until it's acknowledged, thus while waiting for acknowledgement; analogue values are transmitted in every third telegram.

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Yes	Yes	If there are no process- or system-messages to transmit, SU200 will continuously alternate between transmission of kWh counter values and analogue input values. When a new process- or system-message is generated, SU200 will transmit this message for 2 out of 3 times and analogue values in every third telegram until the message is acknowledged.
N/A	N/A	Message transmission blocked (In local control mode) As described in the above situations but as if SU200 has no process- or system-messages to transmit

Table 2 - Transmission of various types of telegrams

Four different types of telegram structures are used for communications:

- Message telegram (consisting of process messages or system messages)
- Analogue value telegram
- General scan telegram
- kWh counter telegram

Figure 17 shows the principle arrangement of the different telegram structures.

Byte	**Message telegram**		**General scan telegram**		**Analogue value telegram**
1.	Control #1		Control #1		Control #1
2.	Control #2		Control #2		Control #2
3.	Digital input 1 to 8		Digital input 1 to 8		Digital input 1 to 8
4.	Digital input 9 to 16		Digital input 9 to 16		Digital input 9 to 16
5.	Digital input 17 to 24		Digital input 17 to 24		Digital input 17 to 24
6.	Digital input 25 to 32		Digital input 25 to 32		Digital input 25 to 32
7.	Digital input 33 to 40		Digital input 33 to 40		Digital input 33 to 40
8.	Signal identification (L)	1. message	Timestamp: days (L)	common time	Analogue input #1 (L)
9.	Signal identification (H)		Timestamp: days (H)		Analogue input #1 (H)
10.	Timestamp: days (L)		Timestamp: ms (LL)		Analogue input #2 (L)
11.	Timestamp: days (H)		Timestamp: ms (LH)		Analogue input #2 (H)
12.	Timestamp: ms (LL)		Timestamp: ms (HL)		Analogue input #3 (L)
13.	Timestamp: ms (LH)		Timestamp: ms (HH)		Analogue input #3 (H)
14.	Timestamp: ms (HL)		Signal identification (L)	1. message	Analogue input #4 (L)
15.	Timestamp: ms (HH)		Signal identification (H)		Analogue input #4 (H)
16.	Signal identification (L)	2. message	Signal identification (L)	2. message	Analogue input #5 (L)
17.	Signal identification (H)		Signal identification (H)		Analogue input #5 (H)
18.	Timestamp: days (L)		Signal identification (L)	3. message	Analogue input #6 (L)
19.	Timestamp: days (H)		Signal identification (H)		Analogue input #6 (H)
20.	Timestamp: ms (LL)		Signal identification (L)	4. message	Analogue input #7 (L)
21.	Timestamp: ms (LH)		Signal identification (H)		Analogue input #7 (H)
22.	Timestamp: ms (HL)		Signal identification (L)	5. message	Analogue input #8 (L)
23.	Timestamp: ms (HH)		Signal identification (H)		Analogue input #8 (H)
24.	Signal identification (L)	3. message	Signal identification (L)	6. message	(not used)
25.	Signal identification (H)		Signal identification (H)		(not used)
26.	Timestamp: days (L)		Signal identification (L)	7. message	(not used)
27.	Timestamp: days (H)		Signal identification (H)		(not used)
28.	Timestamp: ms (LL)		Signal identification (L)	8. message	(not used)
29.	Timestamp: ms (LH)		Signal identification (H)		(not used)
30.	Timestamp: ms (HL)		(not used)		(not used)
31.	Timestamp: ms (HH)		(not used)		(not used)
32.	Control #2		Control #2		Control #2

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Figure 17 - Structure of telegrams from SU200 to master

Byte	**kWh counter telegram**
1.	Control #1
2.	Control #2
3.	Digital input 1 to 8
4.	Digital input 9 to 16
5.	Digital input 17 to 24
6.	Digital input 25 to 32
7.	Digital input 33 to 40
8. 9.	kWh counter # 1(L) kWh counter # 1(H)
10. 11.	kWh counter # 2(L) kWh counter # 2(H)
12. 13.	kWh counter #3 (L) kWh counter #3 (H)
14. 15.	kWh counter #4 (L) kWh counter #4 (H)
16. 17.	kWh counter #5 (L) kWh counter #5 (H)
18. 19.	kWh counter #6 (L) kWh counter #6 (H)
20. 21.	kWh counter #7 (L) kWh counter #7 (H)
22. 23.	kWh counter #8 (L) kWh counter #8 (H)
24.	kWh counter #9 (L)
25.	kWh counter #9 (H)
26.	kWh counter #10 (L)
27.	kWh counter #10 (H)
28.	kWh counter #11 (L)
29.	kWh counter #11 (H)
30.	kWh counter #12 (L)
31.	kWh counter #12 (H)
32.	Control #2

(L) Low-byte of the word (16 bit code)

(H) High-byte of the word

(LL) Low-byte of the lower order word of the double-word (32 bit code)

(LH) High-byte of the lower order word of the double-word

(HL) Low-byte of the higher order word of the double-word

(HH) High-byte of the higher order word of the double-word

Figure 18 - Continued: Structure of telegrams from SU200 to master

Two control bytes and the actual state of all digital inputs are incorporated in all telegram types and is permanently updated and transmitted.

The message telegram consists of control bits incorporated into control bytes #1 and #2, the actual state of all digital inputs and a maximum of three messages. The input status is permanently updated and transmitted. Each message consists of its signal identification (double-word / two bytes) and the time of acquisition in a six byte code, consisting of the days since 01.01.1984 and the milliseconds after the last full day from 00.00.00 ^{h} onward.

The analogue value telegram consists of the control bits incorporated into control bytes #1 and #2, the actual state of all digital inputs and the actual measured values of the 8 channels. The input status and the analogue values are permanently updated and transmitted.

The kWh counter telegram consists of the control bits incorporated into control bytes #1 and #2, the actual state of all digital inputs and the actual kWh counter inputs of the 12 kWh counter channels. The input status and the kWh counter values are permanently updated and transmitted.

The general scan telegram is only transmitted after a request from the central control station and consists likewise of control bits incorporated into control bytes #1 and #2 and the actual state of all digital inputs. In contrast to the message telegram, the general scan telegram consists of eight messages with only one common scan time information.

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4.5.2. From master to SU200

For the data reception from the central control station, the telegram is structured with 12 bytes of user data. Figure 19 shows the principle arrangement of the telegram.

Byte	
1.	Control #1
2.	Control #2
3.	Relay output 1 to 8
4.	Relay output 9 to 16
5.	Relay output 27 to 24
6.	Setpoint-time: days (L)
7.	Setpoint-time: days (H)
8.	Setpoint-time: ms (LL)
9.	Setpoint-time: ms (LH)
10.	Setpoint-time: ms (HL)
11.	Setpoint-time: ms (HH)
12.	(not used)

Figure 19 - Structure of telegrams from master to SU200

(L)	Low-byte of the word (16-bit code)
(H)	High-byte of the word
(LL)	Low-byte of the lower order word of the double-word (32 bit code)
(LH)	High-byte of the lower order word of the double-word
(HL)	Low-byte of the higher order word of the double-word
(HH)	High-byte of the higher order word of the double-word

The telegram consists of control bits incorporated into control bytes #1 and #2, output orders for the 24 output channels and a time information in a six byte code, consisting of the days since 01.01.1984 and the milliseconds after the last full day from 00.00.00 ^{h} onward.

The time information serves as an advanced lead-time for the initial setting of the internal clock of SU200 (see chapter *Clock control*).

4.6. Communications control

Communication between the central control stations and SU200 is controlled and co-ordinated by way of status-bits in the telegrams.

4.6.1. From SU200 to master

Control bytes #1 and #2 of the telegrams from SU200 to the master serve for communications control.

4.6.1.1. Control byte #1

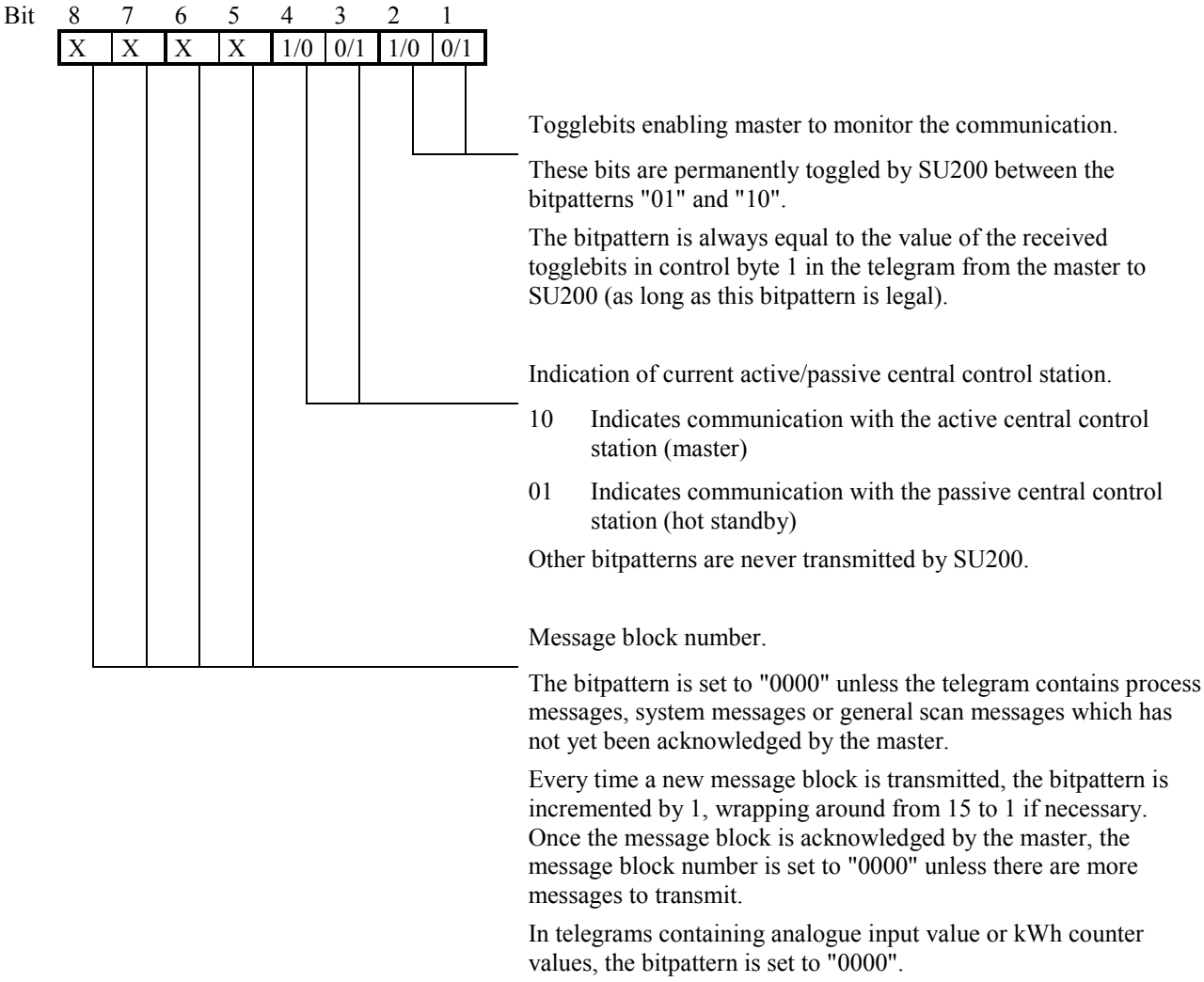
Bit 8 7 6 5 4 3 2 1
X X X X 1/0 0/1 1/0 0/1
Togglebits enabling master to monitor the communication.
These bits are permanently toggled by SU200 between the bitpatterns "01" and "10".
The bitpattern is always equal to the value of the received togglebits in control byte 1 in the telegram from the master to SU200 (as long as this bitpattern is legal).
Indication of current active/passive central control station.
10 Indicates communication with the active central control station (master)
01 Indicates communication with the passive central control station (hot standby)
Other bitpatterns are never transmitted by SU200.
Message block number.
The bitpattern is set to "0000" unless the telegram contains process messages, system messages or general scan messages which has not yet been acknowledged by the master.
Every time a new message block is transmitted, the bitpattern is incremented by 1, wrapping around from 15 to 1 if necessary. Once the message block is acknowledged by the master, the message block number is set to "0000" unless there are more messages to transmit.
In telegrams containing analogue input value or kWh counter values, the bitpattern is set to "0000".

Figure 20 - Arrangement of control byte #1 in telegram from SU200 to master

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4.6.1.2. Control byte #2

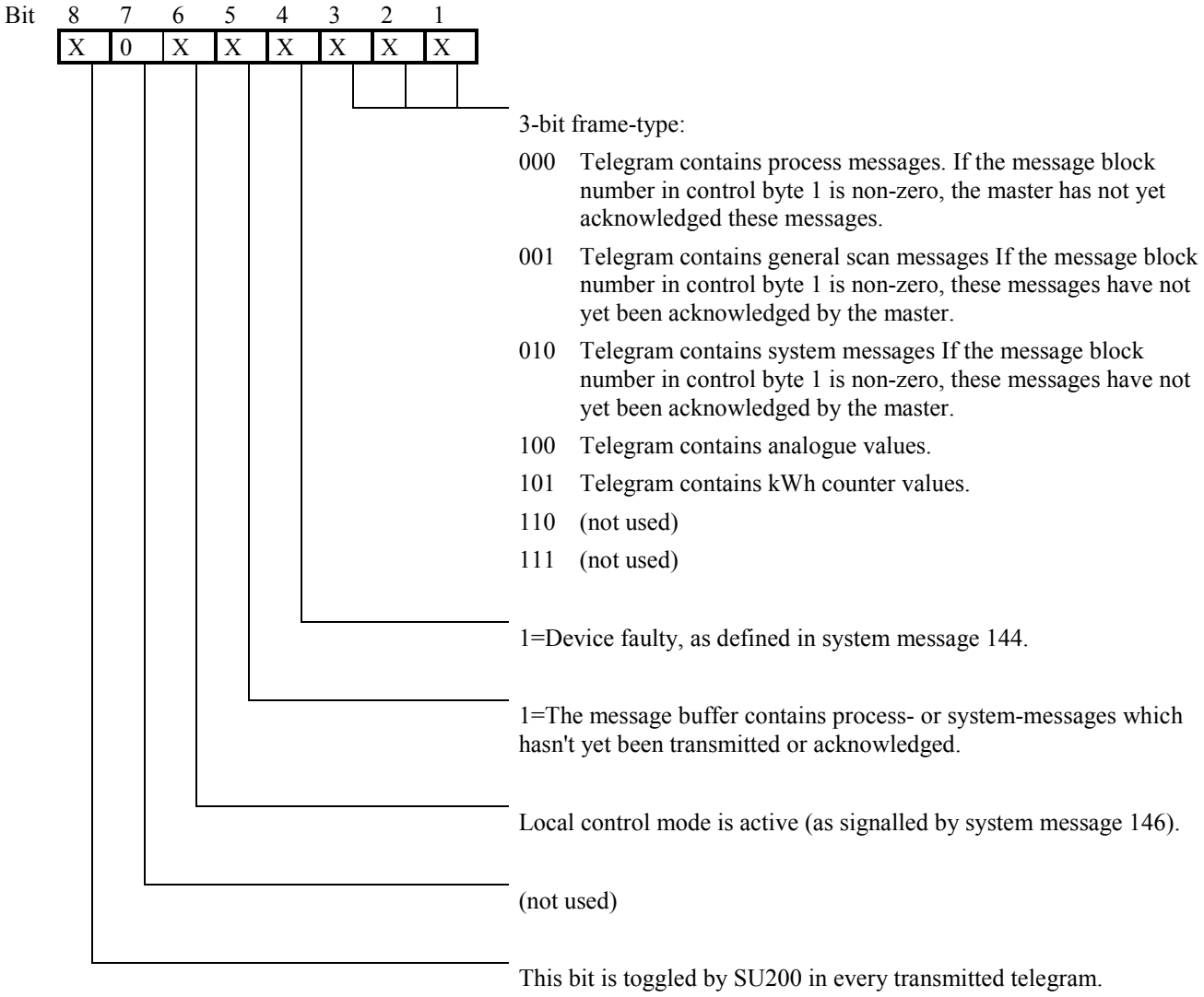
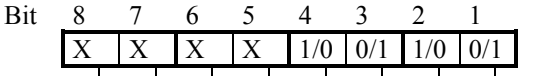

Bit 8 7 6 5 4 3 2 1
X 0 X X X X X X
3-bit frame-type:
000 Telegram contains process messages. If the message block number in control byte 1 is non-zero, the master has not yet acknowledged these messages.
001 Telegram contains general scan messages If the message block number in control byte 1 is non-zero, these messages have not yet been acknowledged by the master.
010 Telegram contains system messages If the message block number in control byte 1 is non-zero, these messages have not yet been acknowledged by the master.
100 Telegram contains analogue values.
101 Telegram contains kWh counter values.
110 (not used)
111 (not used)
1=Device faulty, as defined in system message 144.
1=The message buffer contains process- or system-messages which hasn't yet been transmitted or acknowledged.
Local control mode is active (as signalled by system message 146).
(not used)
This bit is toggled by SU200 in every transmitted telegram.

Figure 21 - Arrangement of control byte #2 in telegram from SU200 to master

4.6.2. From master to SU200

Control bytes #1 and #2 of the telegrams from the master to SU200 serve for communications control.

4.6.2.1. Control byte #1



Togglebits enabling SU200 to monitor the communication.

These bits should be permanently toggled by the central control stations between the bitpatterns "01" and "10".

SU200 will assume that the connection to the central control station is interrupted if no toggling occurs within 4 seconds.

See chapter *Figure 23* - Arrangement of control byte #2 in telegram from master to SU200

Communications monitoring.

The combination "00" or "11" is illegal. Illegal telegrams are ignored by SU200.

Request for active/passive central control station.

10 The central control station wants to be active.

01 The central control station wants to be passive.

The combination "00" or "11" is illegal. Illegal telegrams are ignored by SU200.

See chapter *Redundancy*.

If both central control stations (in dual master mode) want to be active, this is interpreted by SU200, as both units want to be passive.

Acknowledgement of a message block.

This bitpattern should be set-up by the master in order to acknowledge the receipt of a message block.

When SU200 transmits a message block with messages, which hasn't yet been acknowledged, a new message block number is transmitted. The master signals the receipt of the message block by returning the received message block number in these bits.

This bitpattern is ignored in telegrams from passive central control stations.

Figure 22 - Arrangement of control byte #1 in telegram from master to SU200

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4.6.2.2. Control byte #2

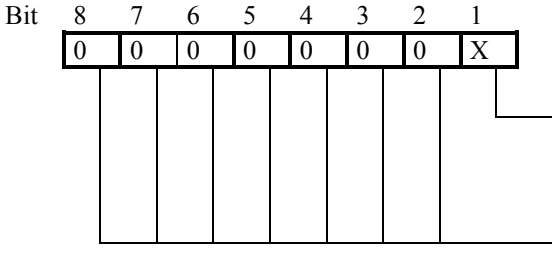
Bit 8 7 6 5 4 3 2 1
0 0 0 0 0 0 0 X
1=The master wants to activate a general scan. This bit is ignored in telegrams from passive central control stations.
(not used)

Figure 23 - Arrangement of control byte #2 in telegram from master to SU200

4.6.3. Communications monitoring

Communications monitoring is done on both sides of the fieldbus link. In addition to the data transfer monitoring carried out by the PROFIBUS master, each SU200 is permanently monitoring the data transfer link via the toggle bits in control byte 1 received from the master.

The bit-patterns "00" or "11" are illegal. Illegal telegrams are ignored by SU200.

If a telegram with a new bitpattern in the togglebits isn't received by SU200 every four second, a communications error is recognised and the actual command outputs are reset.

As soon as a new valid telegram is received, communications is considered as healthy again.

4.7. Cyclic buffer

SU200 unit is equipped with a message buffer for storage of up to 500 process messages and 50 system messages The buffer is designed in a write-over mode, i.e. in case of a buffer overflow, the "oldest" stored message is overwritten.

Messages, which have been transmitted to the central control station, are kept stored and can still be read using the SU200DIA application

Transmitted messages are marked as acknowledged as soon as the central control station returns the message telegram number, see chapter *From master to SU200.*

4.8. Clock control

The date and time information for time tagging of messages is provided via the internal clock of SU200. The internal clock is designed with an accuracy of 10^{-5} (max. 36 ms/hour)

After start-up of SU200, the internal clock starts with 00:00:000 ^{h} and time tagging of messages commences with the date 1984.01.01.

As soon as the communications link with the active master is in service, the internal clock of SU200 is set provisionally with the lead time information received via the first telegram from the central control station. Subsequently, the time mark of messages, which have been written into the message puffer prior to the reception of the first telegram, is corrected relatively to the time difference.

The time information sent by the central control station is given a few seconds ahead of the actual time and serves as a lead-time for the setting of the internal clock via an external trigger signal.

For the time synchronisation of the internal clock, an optical and electrical trigger signal input is provided.

The unit is designed to receive a time synchronising impulse (at least 100µs) from an external master clock

each minute, whereas the synchronisation is initiated by the rising edge of the signal.

In output mode of the LED indication, LED #39 mirrors the state of the time synchronising input by way of lighting up as long as an optical or electrical signal is applied

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5. Controls and displays

The following control and indication elements are provided on SU200 unit:

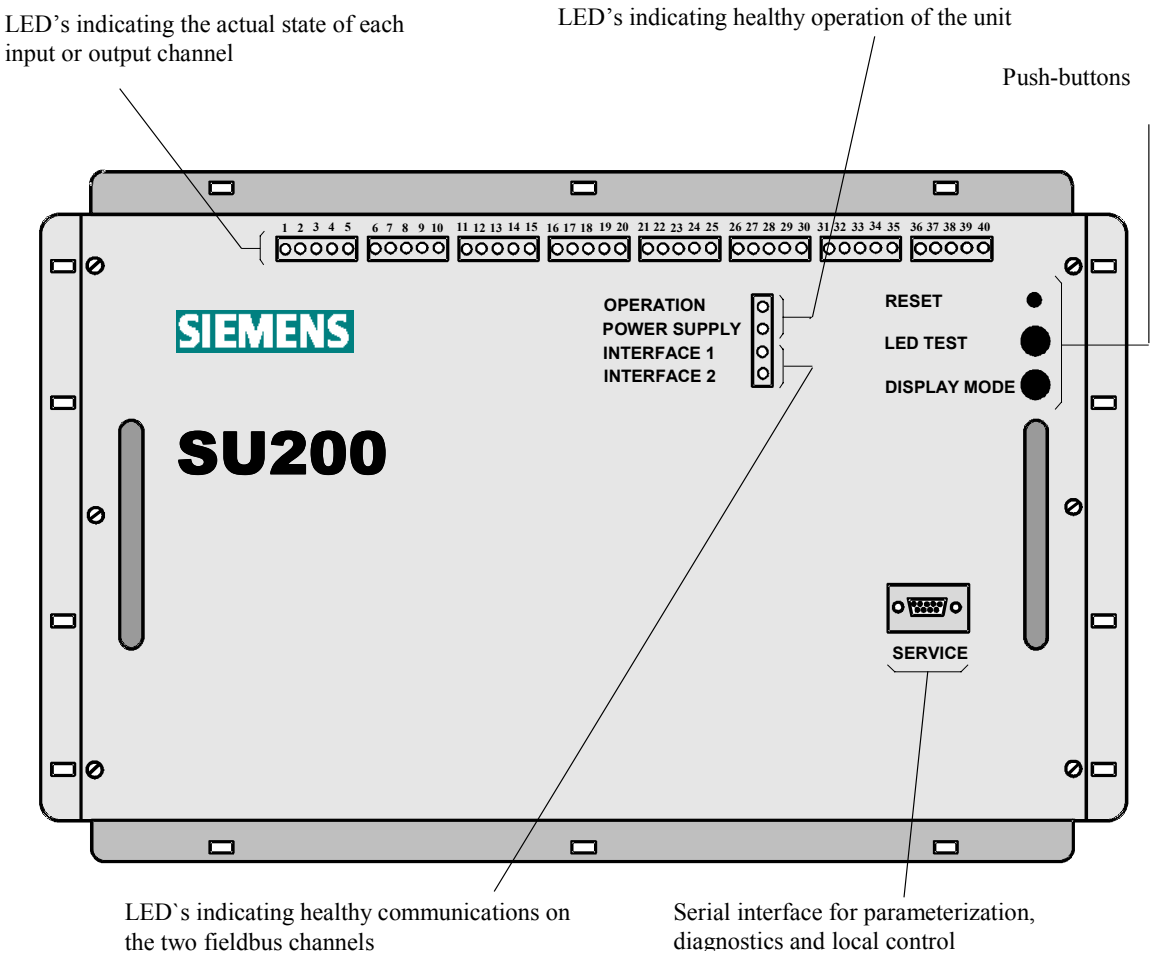
LED's indicating the actual state of each input or output channel
LED's indicating healthy operation of the unit
Push-buttons
1 2 3 4 5
6 7 8 9 10
11 12 13 14 15
16 17 18 19 20
21 22 23 24 25
26 27 28 29 30
31 32 33 34 35
36 37 38 39 40
SIEMENS
SU200
OPERATION
POWER SUPPLY
INTERFACE 1
INTERFACE 2
RESET
LED TEST
DISPLAY MODE
SERVICE
LED`s indicating healthy communications on the two fieldbus channels
Serial interface for parameterization, diagnostics and local control

Figure 24 - Buttons and LED's

5.1. LED display

The green LED named *OPERATION* indicates the operational status of the device.

Light	*Indication*
Steady light	Auxiliary power is switched on and SU200 is properly functioning
1 Hz flashing light	Internal failure, see chapter *Self-monitoring*.
Dark	Auxiliary power off

Table 3 - *OPERATION* LED

The green LED named *POWER SUPPLY* indicates the status of the auxiliary power supply.

Light	*Indication*

Steady light	Both power supply modules are properly functioning
½ Hz Flashing light	Failure in power supply #1
1 Hz flashing light	Failure in power supply #2
5 Hz Flashing light	Internal monitoring of power supplies faulty or both power supplies defective

Table 4 - *POWER SUPPLY* LED

Power supply monitoring of SU200 is carried out continuously by way of comparing the output voltage level of both power supply modules with an internally set low voltage limit.

Note: The unit does not contain a specific on/off switch for the auxiliary power supply. Therefore SU200 is in operation as soon as an appropriate voltage is applied to one of the two power supply modules.

The two green LED‘s named *INTERFACE 1* and *INTERFACE 2* indicate the operational status of the redundant PROFIBUS interface.

Light	*Indication*
Steady light	Communications interface healthy and in service
Dark	Communications interface out of service or disturbed
1 Hz flashing light	Transmission of messages blocked, SU200 is under local control by means of a connected PC and transmissions of messages are suppressed.

Table 5 - INTERFACE LED’s

Forty green LED’s at the top of SU200 indicate the signal status of each input channel (basic setting), whereas 8 openings on the cover plate are showing five LED‘s in each case.

A set LED indicates an initiated/energised input channel (if positive signal logic is set, see chapter *Parameterisation*).

By clicking the button *DISPLAY MODE*, the display changes to status indication of each command output channel. If command output status is selected, LED #40 is blinking (1 Hz period).

Since all output channels are monitored for correct command output in groups of two channels by way of feedback circuits, always two channels are blocked in case of one channel is faulty.

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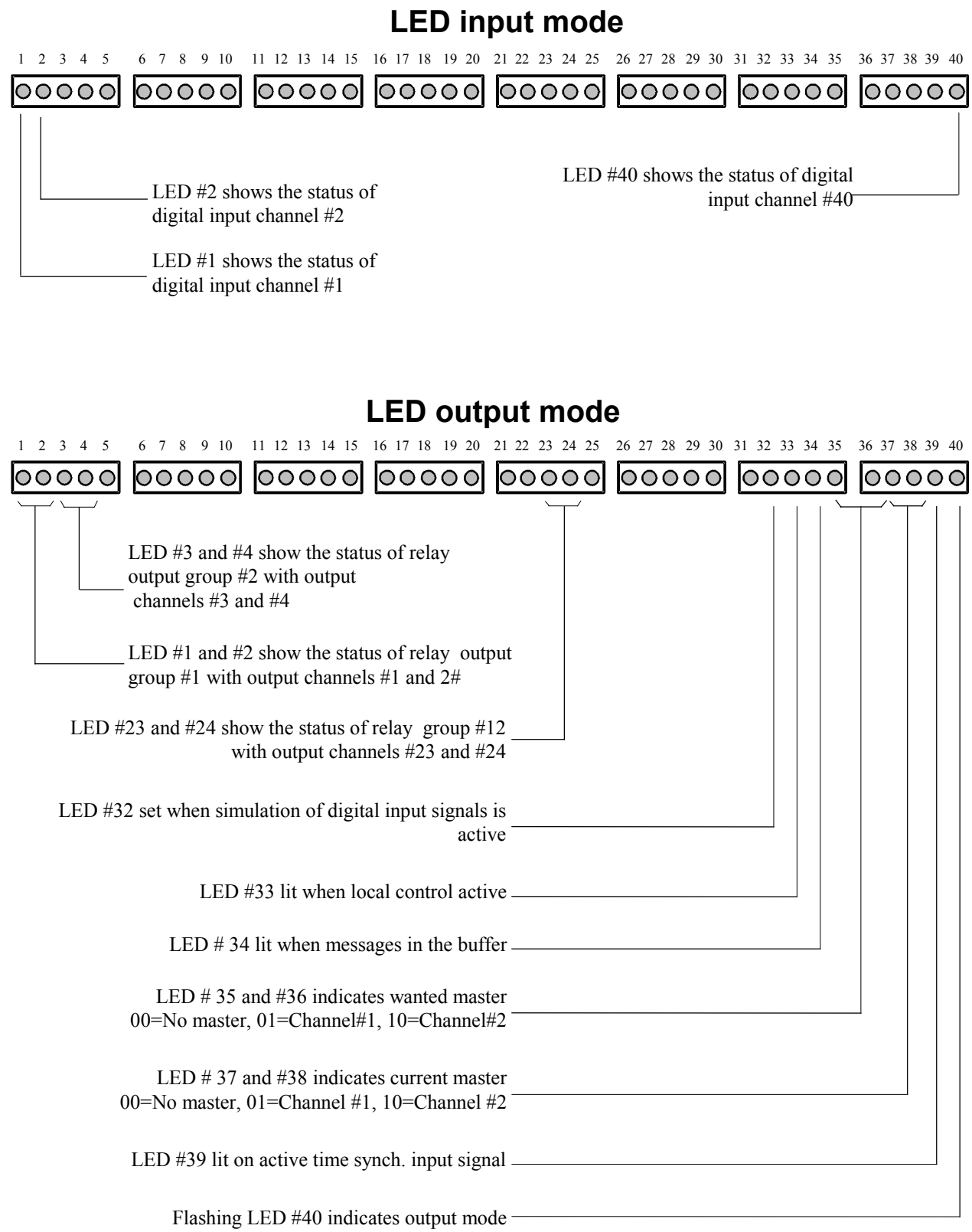
LED input mode
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
LED #2 shows the status of digital input channel #2
LED #1 shows the status of digital input channel #1
LED #40 shows the status of digital input channel #40
LED output mode
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
LED #3 and #4 show the status of relay output group #2 with output channels #3 and #4
LED #1 and #2 show the status of relay output group #1 with output channels #1 and 2#
LED #23 and #24 show the status of relay group #12 with output channels #23 and #24
LED #32 set when simulation of digital input signals is active
LED #33 lit when local control active
LED # 34 lit when messages in the buffer
LED # 35 and #36 indicates wanted master 00=No master, 01=Channel#1, 10=Channel#2
LED # 37 and #38 indicates current master 00=No master, 01=Channel #1, 10=Channel #2
LED #39 lit on active time synch. input signal
Flashing LED #40 indicates output mode

Figure 25 - Status LED's

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5.2. Buttons

RESET button

Clicking the *RESET* button initiates a hardware reset. This causes SU200 unit to perform a complete restart.

During restart, all LED‘s are lighting up for a short moment.

The *RESET* button should only be pressed for the purpose of clearing faults.

LED TEST button

When this button is pressed, a firmware test is carried out and all the LED‘s are switched on for the time of clicking the button. This indicates that SU200 is operating properly.

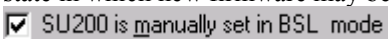
DISPLAY MODE button

With this button, a changeover between digital input status indication and command output status indication is possible. LED #40 will flash while command output status is displayed,

Boot mode

If both the *LED TEST* push button and the *DISPLAY MODE* button are pressed while a reset/power-up is performed, all parameters are set to the factory-set values. These values are described in chapter *Parameterisation*.

Firmware download mode

If the *DISPLAY MODE* button (only) is pressed while a reset/power-up is performed, the system enters a state in which new firmware may be downloaded. Use the firmware tool with checkbox 

marked.

5.3. Serial interfaces

Service channel interface

A serial channel (V.24 / V.28, RS-232, 9-pins SUB-D) is provided for parameterisation, diagnostics and local control.

Use a null-modem cable where pins 2,3 and 7 is connected directly from the PC to SU200.

A DIP switch is provided at the underside of the CPU module and serves for the configuration of this serial channel. The DIP switch is factory-set to V.24 / V.28 transmission standard (RS-232).

Download channel interface

A serial channel (V.24 / V.28, RS-232, 9-pins SUB-D) is provided for downloading of new firmware and firmware access.

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6. SU200DIA

SU200DIA application enables the user to set read/write operational parameters and read process data in order to carry out local diagnosis or fault tracing.

Figure 26 shows the start-up window of SU200DIA.

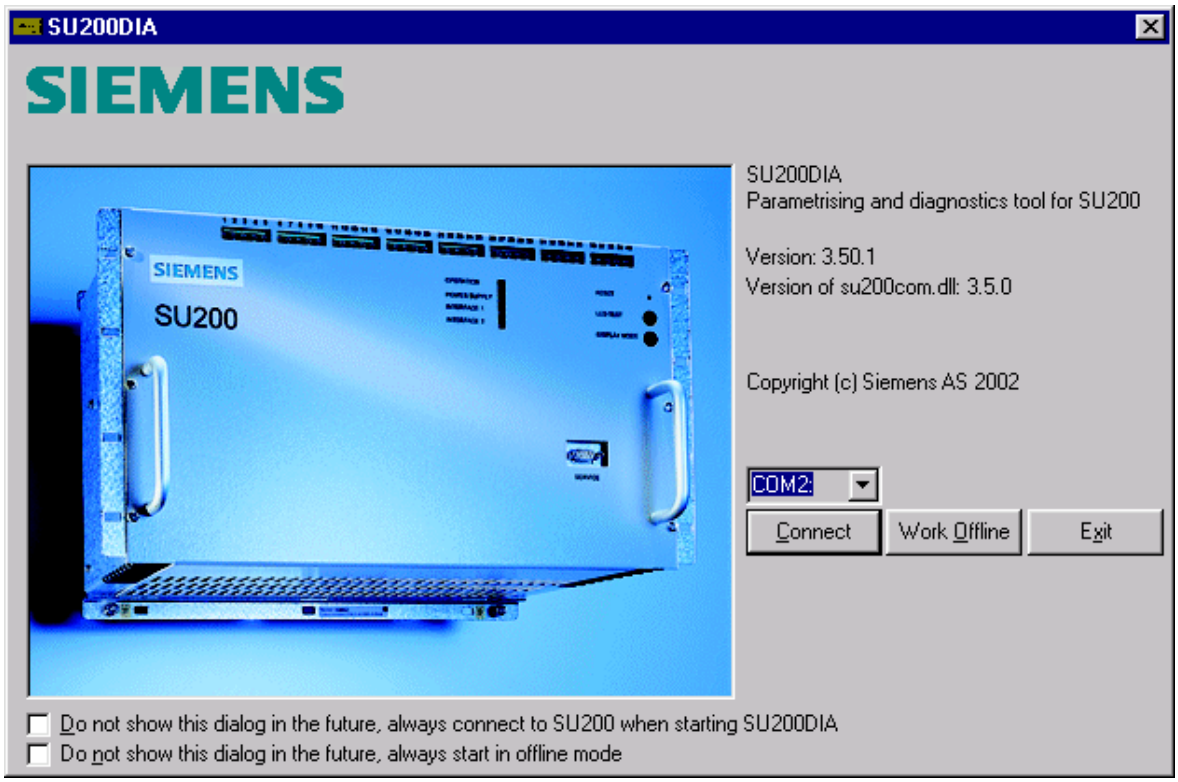

Figure 26 - Start-up window of SU200DIA

Button	*Function*
Connect	Click this button if the PC is connected to a SU200. Parameters and messages will be read from SU200 and shown in main window. The communication port can be selected prior to attempting communicate with SU200.
Work Offline	No data are read from SU200, the main window will show default parameters. Parameter-files can be opened and viewed. The parameters can be read from SU200 at any later point.

The version of SU200DIA as well as it's communication component (`su200com.dll`) are shown. The user may select to not show the start-up window the next time SU200DIA is started. This setting is stored in the *Startup* key in the file `consi.ini` file in the Windows directory.

Figure 27 shows the main window of SU200.

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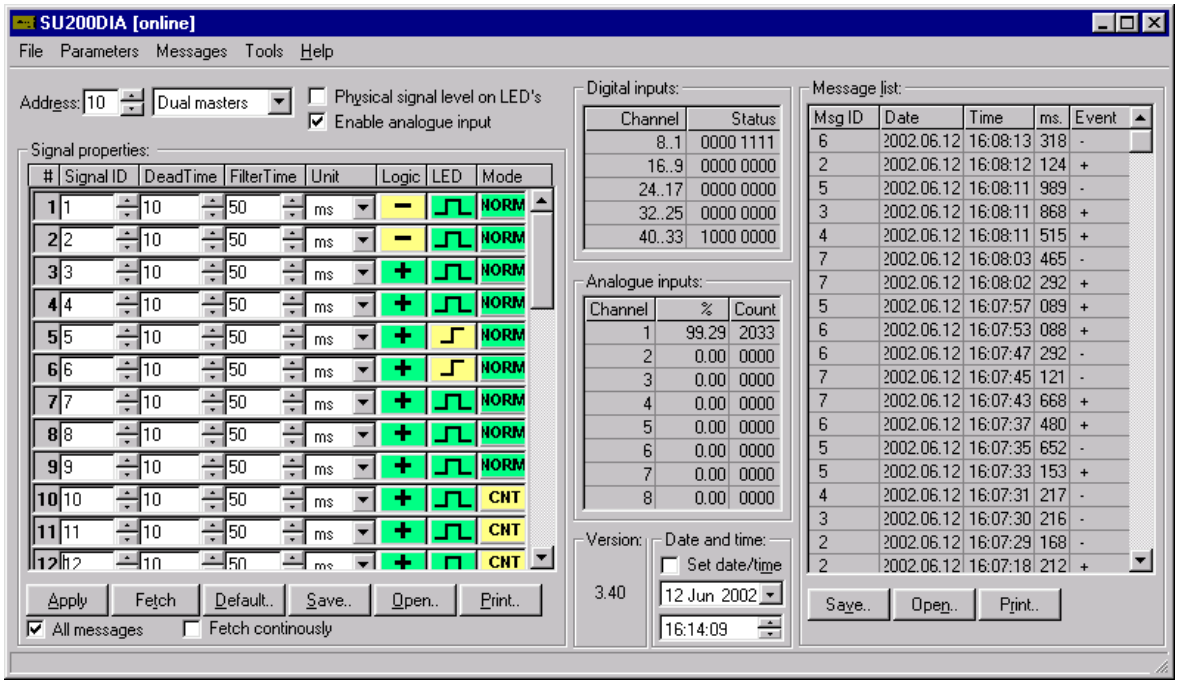

Figure 27 - Main window of SU200DIA

Parameters and diagnostics are read from SU200 clicking the *Fetch* button. If *Fetch continuously* checkbox is checked, data are read continuously until cancelled by user.

All parameters can be set to their default values clicking the *Default* button.

Parameters are transferred to SU200 clicking the *Apply* button.

Parameters may be saved in parameter files. The files can be opened and displayed.

The content of the *Message list* and *Digital inputs* may be saved in a message-file. Message-files can be opened and viewed.

The *Analogue inputs* list is only updated when data are read from SU200. This values are not saved in a file.

A *Tools* menu gives access to the following functions:

- A mode enabling local control of the relay outputs
- Simulation of the signal level of all 40 digital inputs
- Programming of rules for interlocking of commands
- View/modify impulse counter values
- Configuring fail-safe state
- Configure internal system parameters
- Selection of communication port on PC
- Firmware tool for low-level fault-tracing and downloading of new firmware

6.1. Parameterisation

The following operation parameters can be set in SU200:

- PROFIBUS address
- Master mode, single master or dual master configuration
- Enable/disable analogue input
- Signal ID of individual digital inputs, necessary for data logging and data distribution at the central control stations
- LED mode; how digital inputs are indicated on the LED's
- The normal signal level of the digital inputs, high- or low signal level on alarm

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- Type of digital input; normal (for alarm) or impulse counter
- Timing for message generation

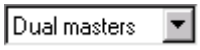
6.1.1. PROFIBUS address

Every SU200 unit has a PROFIBUS address that is unique on the bus.

A value in the range from 3 to 125 is allowed. The station numbers 1 and 2 are reserved for central control stations (masters).

SU200 will instantly accept the new station address when the value is changed (not only at power-up).

6.1.2. Master mode



SU200 allows multi-master configuration with central control stations. The following modes are applicable:

Mode	*Function*
Dual masters	SU200 will communicate on and monitor both fieldbus links in a redundant mode.
Single master 1	SU200 unit will communicate on and monitor fieldbus link #1 only.
Single master 2	SU200 unit will communicate on and monitor fieldbus link #2 only.

Table 6 - Setting master mode in SU200DIA

6.1.3. Enable analogue inputs

If analogue input is disabled, analogue input values are not acquired/transmitted to the central control station nor displayed in SU200DIA application.

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6.1.4. Signal ID

Each of the digital inputs has a signal ID, which is unique in the entire control system and is pre-condition for a proper processing and distribution of signals.

The range of the signal ID is 0 to 32767.

If the signal ID is set to 0, the signal status of the respective input channel is reported as normal, but no message is generated by SU200. However, if a general scan telegram is transmitted to SU200, the signal status of all channels is reported independent on whether the signal identification is 0 or any other number.

Each of the digital inputs of SU200 unit should have a unique ID (exception: ID number 0 may be specified for several channels).

6.1.5. LED

A LED mode may be specified for each of the digital inputs.

If *Follow mode* is selected, the LED will continuously indicate the current alarm status or the physical input signal status (depending on the setting of the *Physical signal level on LED's* parameter).

If *Storage mode* is checked, the LED indication of the digital input is stored. This applies both for indication of alarm-status or physical input signal. The LED will remain lit until the LED TEST button is pressed.

If *Physical signal level on LED's* is unchecked, SU200 will indicate alarms on the LED's. Since both positive and negative logic may be applied to digital inputs, a lit LED may not necessary indicate a high signal on the input.

If *Physical signal level on LED's l* is checked, SU200 will indicate physical signal levels on the LED's. A high signal on the input will cause the corresponding LED to light even if negative signal logic has been applied.

The *Physical signal level on LED's* parameter is common of all digital inputs, it can not be programmed individually on a per-channel basis.

Physical signal	Programmed setting of Logic	Programmed setting of *Physical signal level on LED's*	LED status
Low	Positive	-	Off [1]
Low	Negative	Off	On
Low	Negative	On	Off [1]
High	Positive	-	On
High	Negative	Off	On
High	Negative	On	Off [1]

[1]: If *Storage mode* is selected, a lit LED will not be switched off before *LED TEST* is pressed.

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6.1.6. Logic

For each of the digital inputs, the user may specify the normal signal level.

If positive logic is checked, a high signal indicates an alarm condition.

If negative logic is checked, a low signal indicates an alarm condition.

6.1.7. Mode

A mode can be set for each of the digital inputs:

Normal mode.

The digital input is an impulse counter. No signal-alarm is generated from the digital input. The logic level parameter does not apply. The LED will be continuously switched off. Read more about impulse counters in chapter 6.3.4.

6.1.8. Timing

The user may define a *Dead time* and a *Filter time* for each of the digital inputs. A common time unit for both time values can be selected in the *Unit* control.

Both time values serve as defined criteria's for the generation of process messages, the digital input status that is permanently transmitted to the control station is independent of this filtering.

The time values may be set in the range of 1 to 250 of the selected time unit. The time unit may be set to 1ms. , 10 ms., 1 sec. or 10 sec. Thus a time range from 1 ms. to 2550 seconds may be selected.

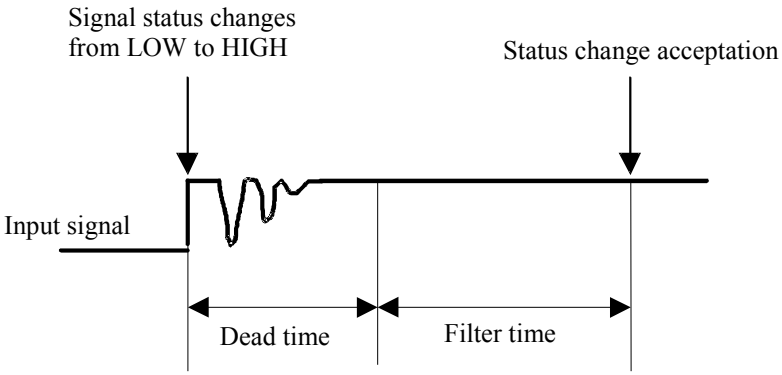

Figure 28 - Dead- and filter time of digital inputs

The dead time is specified in order to give the signal time to settle after a status change of a digital input. Changes in the signal status during this time are not recognised.

If the signal level does not change during the specified filter time, the new signal status is accepted for the generation of a process message.

The dead- and filter-time applies to signal transitions in both directions, from high to low level and from low

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to high level.

6.1.9. Default parameter values

The default parameter values are factory-set. This values can be set as describe din chapter 5.2 or by clicking the *Default* button and then the *Apply* button.

Parameter	*Value*
PROFIBUS address	10
Analogue input enabled	Yes
Signal ID	1 up to 40
Logic	Positive
LED	Follow mode.
	Physical signal level on LED's = 0
Physical signal level on LED's	No
Mode	Normal
Deadtime	10 ms.
Filtertime	50 ms.
Master mode	Dual master

Table 7 - Default parameter values

6.1.10. Managing parameter files

Parameters can be stored in parameter files. The files can be opened and viewed. The files have the extension `PAR`.

The *Parameters* menu consists of the following items:

Menu	*Function*
Open	Opens and displays a parameter-file. No messages or input statuses will be displayed since this data are not stored in the parameter-file. The full path of the file is displayed in the title line of the main window.
Save	Saves the shown parameters on the currently selected parameter-file. If no parameter-file has been opened, the user is prompted for a filename. The extension `PAR` is automatically added to the filename.
Save as..	Allows the user to save the shown parameters in a new file or another file than the file indicated in the title of the main window

Table 8 - Parameter menu in SU200DIA

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6.2. Diagnostics

Diagnostics can be read from SU200 clicking the *Fetch* button.

All messages checked:	Fetch all messages from SU200 including those sent to the PROFIBUS DP masters
All messages unchecked:	Fetch only messages not yet sent to the PROFIBUS DP masters (e.g. if no active PROFIBUS DP master is present)

The following diagnostics are available:

- Version of built-in firmware.
- Date and time in SU200.
- Analogue input values
- Status indication of all digital inputs.
- Process messages, which are written into the message buffer consisting of signal ID, date and time of recognition and signal stage.
- System messages written into the message buffer consists of signal ID, date and time of recognition.

The message list may be stored in a file and later opened again, see chapter *Managing message files*. If the message list displays messages read from a file, the name of the file will be displayed on-screen below the message list.

6.2.1. Firmware version

Figure 29 - Firmware version in SU200DIA

The version of the built-in firmware of SU200 is shown when data are read from SU200.

6.2.2. Date and time

Figure 30 - Date and time in SU200DIA

The date and time in SU200 is displayed when data are read.

Following a power-up, the date/time in SU200 is set to 1. Jan. 1984. The date and time is modified when the first telegram is received from the central control station. Subsequent changes of the date and time are only performed when the time sync signal is raised.

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In order to test SU200 without having a connection to a central control station, the date and time can be set from SU200DIA. Check checkbox *Set date/time* and press the *Apply* button. This will set the date and time in SU200 equal to the date and time in the PC.

The date and time is also stored in the parameter files. When a parameter file is opened, the date and time when the parameters were read from SU200 is displayed.

6.2.3. Message list

Figure 31 - Message list in SU200DIA

The messages are sorted by time of generation; the newest message is displayed in the beginning of the table.

For each message, the following information is displayed:

- Signal ID of process messages: specified by the user
- Signal ID of system messages: internally fixed (see chapter *Self-monitoring*)
- Date (year, month and day) and time (hours, min, sec, and ms.) of signal recognition
- Signal stage of messages in the column labelled +/-:
  + indicates raised process signal (coming)
  - indicates for process cleared signal (going)
  Sys indicates a system message

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6.2.4. Digital inputs

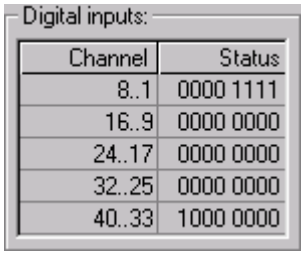

Figure 32 - Digital inputs in SU200DIA

The state of each of the digital inputs is displayed as a "1" or a "0" indicating the logical signal level. This logical signal level is equal to the physical signal level unless negative logic has been applied.

6.2.5. Analogue inputs

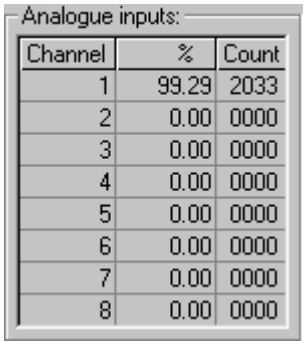

Figure 33 - Analogue inputs in SU200DIA

The read measured analogue input values are displayed as a percentage value for each channel. The nominal input value (± 10V or ± 20mA) is converted into ± 200%.

Analogue inputs are not displayed unless they have been enabled.

6.2.6. Managing message files

Messages and digital input status can be stored in message files. The files can be opened and viewed. The files have the extension `ALM`.

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Menu	*Function*
Open	Opens a message-file and displays the data on the screen. The message file contains messages and digital input status's which was read from SU200. The messages-files have extension `ALM`. The name of the file is displayed below the message list. The menu entries for saving the message file are enabled if the file contains at least one message.
Save	Saves the messages displayed in the message list and the input-status of all input signals in a message-file. Unless a message-file has previously been opened, the user is prompted for a filename. The extension `ALM` is automatically appended to the filename if needed. This menu-entry is disabled if the message list doesn't contain any messages.
Save as..	As Save but the user is always prompted for a new filename even if a message-file is actually open. This menu-entry is disabled if the message list doesn't contain any messages.
Print..	Prints a report with all messages to the printer. This menu-entry is disabled if the message list doesn't contain any messages.

Table 9 - Message menu in SU200DIA

6.3. Tools menu

The *Tools* menu is used to activate special functions in SU200.

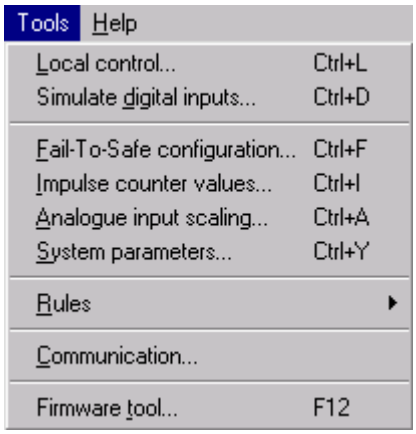

Figure 34 - The *Tools* menu in SU200DIA

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6.3.1. Local Control

Local control mode can be used to control the relays of SU200.

This option is especially important in the course of pre-commissioning of the system, e.g. the control station is not yet installed or not yet ready to operate and the output circuitry of SU200 should be checked.

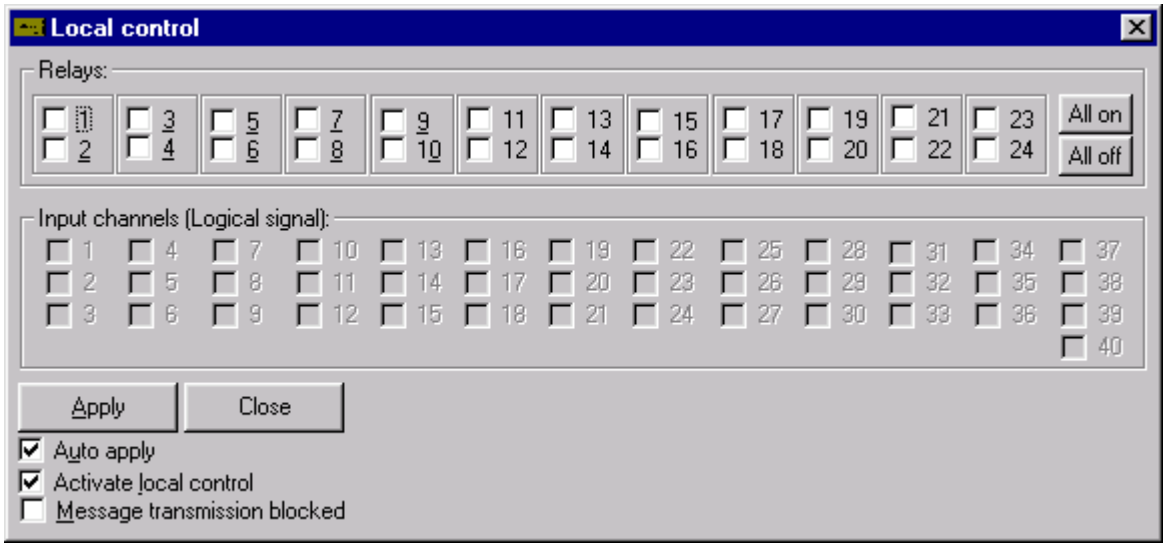

Figure 35 - Local Control in SU200DIA

The local control mode window enables the user to directly control all relays from a PC rather than from the central control station (orders from the central control station are ignored).

When local control mode is started, the current command status of the relays are read and indicated.

The relays can be closed clicking the corresponding checkbox.

The *Activate Local Control* checkbox must be checked in order to control relays. When this button is unchecked, all relays are controlled from the central control station.

Local control mode can not be started while the window for simulation of digital input signals is open.

While local control mode is active, SU200 generates and transmits messages to the central control station unless the checkbox *Message Transmission blocked* is checked and the *Apply* button is clicked. In this case, SU200 will still generate and buffer messages, but the actual transmission of the messages is suspended until the local control mode is deactivated.

Using the *Message Transmission blocked,* the user may to do on-site testing without having unwanted messages transmitted to the central control station. However, since the generated messages are buffered, they will be transmitted as soon as the local control mode is stopped, unless a hardware reset is applied to SU200. Applying hardware reset to SU200 will also stop the local control mode.

The local control mode has higher priority than the interlocking-functions (rules). An output channel normally controlled by the interlocking function can be forced high or low using the local control mode. The interlocking function will regain control of the output channel once the local control mode is deactivated.

While local control mode is active, the status of all digital inputs are periodically read and displayed.

The bottom status-bar of the main window will indicate that local control mode is active.

SU200DIA application is periodically reading the digital inputs of SU200, any disturbance is detected and will cause SU200 to switch off local control mode after 30 seconds.

Local control mode is switched off by closing the window or unchecking the *Activate Local control*

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checkbox. Local control mode will also be switched off when SU200DIA application is terminated.

When local control mode is switched off, SU200 unit keeps the current relay outputs unchanged until new commands are received from the active central control station.

If no fieldbus is connected or faulty communications is detected, all command outputs are switched off as soon as local control mode is exited.

Communications monitoring is not carried out while local control mode is active; thus the command outputs are not switched off, even if the communications central control station is interrupted.

The *Fetch* button is used to read settings from SU200. The *Apply* button is used to write settings to SU200. If *Auto apply* is checked, every single change is applied immediately.

6.3.2. Simulate Digital Inputs

All digital inputs can be manually set to a high or low signal level. The simulated signal level is handled by SU200, as it was the physical signal level, consequently the simulated signal level will affect all functions which uses digital inputs.

Typically the simulation of digital inputs will be used for testing the interlocking (rule) function.

Note that the function can not be started while the window for local control mode is open.

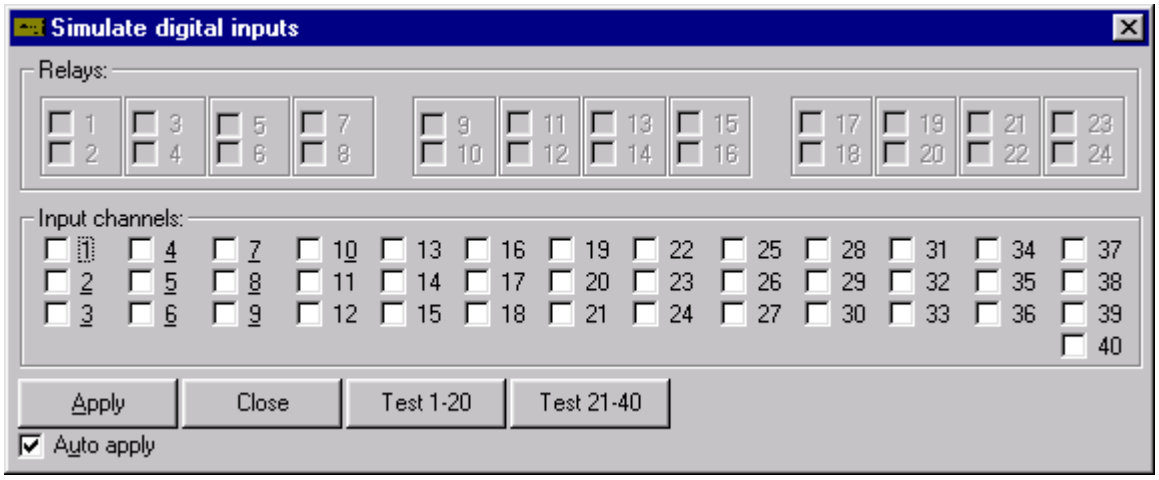

Figure 36 - Simulate digital inputs in SU200DIA

An input signal can be set or reset clicking on the corresponding checkbox.

The physical input status is displayed and simulated. Negative logic is ignored.

A maximum of 20 digital inputs can be set.

The bottom status-bar of the main window will indicate that simulation of digital inputs is active.

The simulation of digital inputs is stopped when the window is closed or when SU200DIA is terminated. When the simulation is stopped, the inputs are immediately set according to the level of the physical input signals.

SU200DIA will read and display the relay output status from SU200. This enables the user to see the effect the digital inputs has on the programmed rules (the interlocking function).

SU200DIA application is periodically reading the relay status from SU200, any disturbance is detected by SU200 and causes digital inputs to be automatically switched off after 30 seconds.

The *Fetch* button is used to read settings from SU200. The *Apply* button is used to write settings to SU200. If *Auto apply* is checked, every single change is applied immediately.

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6.3.3. Fail-To-Safe configuration

If the PROFIBUS communication is interrupted or if no active PROFIBUS DP master are recognised, SU200 will enter a fail-to-safe state.

In this state, the control of each relay can be configured:

- Open relay
- Keep relay in its current position

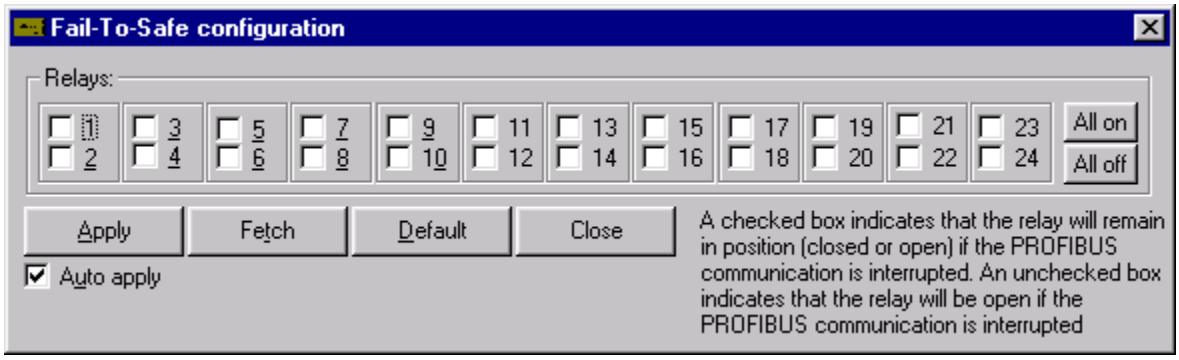

Figure 37 - The fail-to-safe configuration in SU200DIA

The window displays one checkbox per relay. A checked box indicates that the relay will remain in position (closed or open) if the PROFIBUS communication is interrupted. An unchecked box indicates that the relay will be open if the PROFIBUS communication is interrupted.

If the *Default* button is pressed, all checkboxes is set with predefined check-marks for the default configuration.

The *Fetch* button is used to read settings from SU200. The *Apply* button is used to write settings to SU200. If *Auto apply* is checked, every single change is applied immediately.

6.3.4. Impulse counter values

Activating this function from the tools menu, will display the window shown in Figure 38. This window can be used to view/edit impulse counter values. Any digital input channel can be the source of an impulse counter. Configuration of digital input channels to be used for impulse counters is performed in the main window of SU200DIA, see Figure 27.

SU200 maintains 12 counter-registers that can be used to count e.g. kWh impulse signals. Every register is associated with a digital input channel.

For digital input channels configured as counters the following apply:

- If the input level is high for min. 20 ms, the corresponding counter register is incremented by 1. The pause time between pulses is not monitored.
- No signal-alarms is generated for the channel.
- The applied dead/filter-time parameter for the channel is not used.
- The logic level (positive or negative) parameter does not apply.
- The status of the input channel (high or low) is available as “normal”.
- The LED will be continuously switched off.

The counter registers will overflow from 0xFFFF to 0. The values are stored in volatile memory and thus cleared at power-up.

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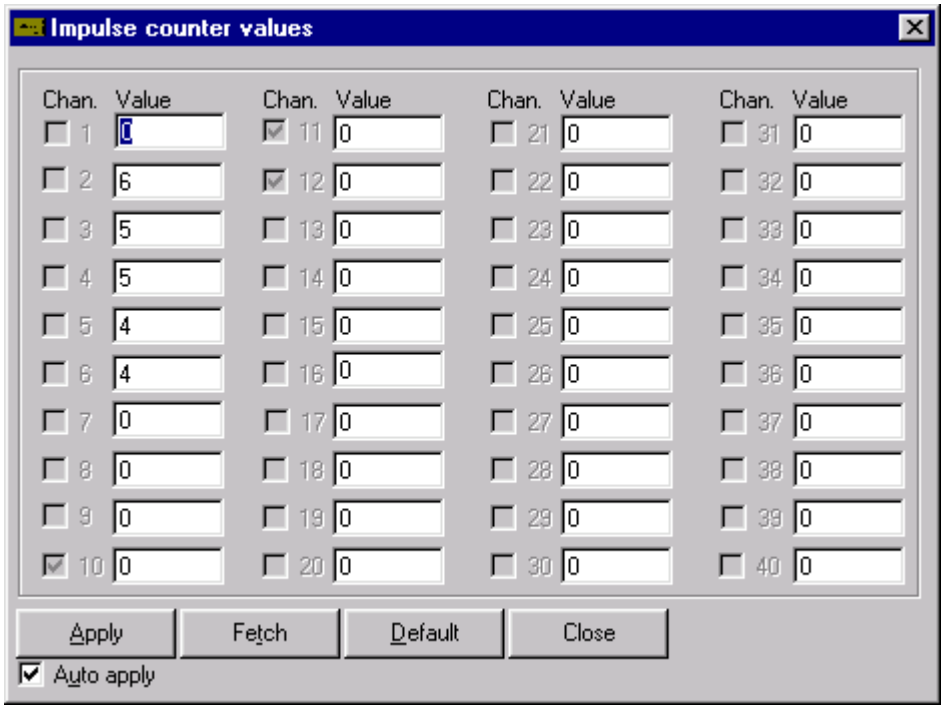

Figure 38 - Impulse counters in SU200DIA

The configuration is stored in the parameter files among other configuration data.

The *Fetch* button is used to read settings from SU200. The *Apply* button is used to write settings to SU200. If *Auto apply* is checked, every single change is applied immediately.

6.3.5. Analogue input scaling

Each of the analogue input raw values from the AD converter (12-bits+sign) are scaled by a fraction equal to $\frac{4095}{\text{denominator}}$.

From the window shown in Figure 39, the denominator of the scaling fraction can be set individually for all analogue input channels. The final result is truncated to a range from –4096 to 4095.

The default value is 3236. No scaling will be applied if the value 0 is selected

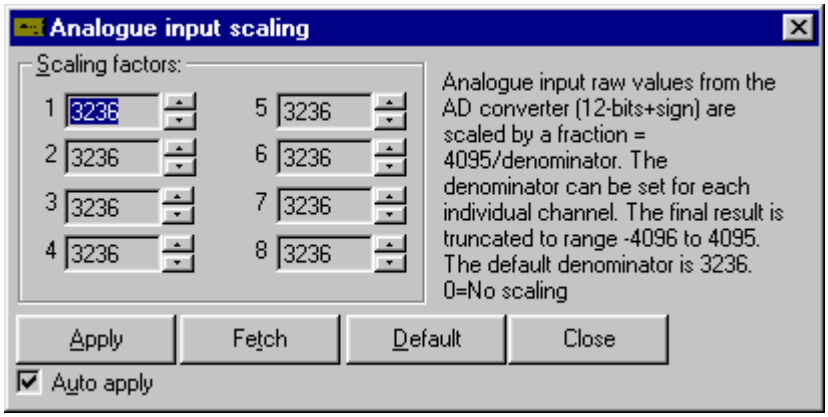
Analogue input scaling
Scaling factors:
Analogue input raw values from the AD converter (12-bits+sign) are scaled by a fraction = 4095/denominator. The denominator can be set for each individual channel. The final result is truncated to range -4096 to 4095. The default denominator is 3236. 0=No scaling
Apply
Fetch
Default
Close
Auto apply

Figure 39 - The analogue input scaling configuration in SU200DIA

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The *Fetch* button is used to read settings from SU200. The *Apply* button is used to write settings to SU200. If *Auto apply* is checked, every single change is applied immediately.

6.3.6. System parameters

The window shown in Figure 40 can be used to change internal system parameters of SU200.

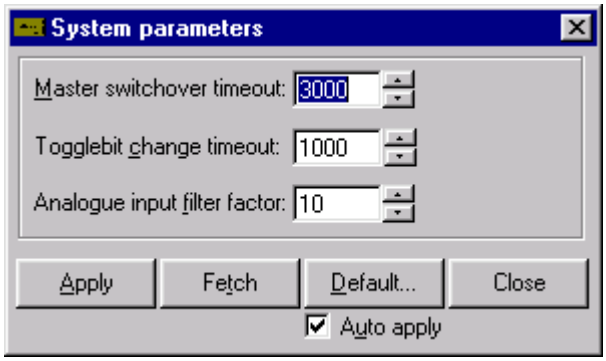

Figure 40 - System parameters window in SU200DIA

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Parameter	*Description*
Master switchover timeout	SU200 can be controlled from one out of two PROFIBUS DP masters through the redundant PROFIBUS interface. During the switchover of active PROFIBUS DP master, there may be a short time-period in which none or both DP masters wants to control SU200. The maximum time-period can be set with the *Master switchover timeout* parameter. If this time is exceeded, SU200 will enter a fail-to-safe state. Depending on the set fail-to-safe configuration, relays may be opened in this state.
Togglebit change timeout	In the PROFIBUS telegrams sent to SU200 from the active PROFIBUS DP master, two bits are used to indicate presence of new data. Read more about this in chapter 4.6.1.1. If this two bits remains frozen for the time set by the *Togglebit change timeout* parameter, SU200 will assume that connection is lost with the active PROFIBUS master and enter a fail-to-safe state.
Analogue input filter factor	Filter factor which is used to stabilise current readings. All values are filtered according to the formula $Value = \frac{(n-1)\cdot Value + Sample}{n}$ n= Analogue input filter factor No filtering is applied if *Analogue input filter factor* is set to 0.

6.3.7. Rules

A programmable interlocking function controls relays in SU200 using digital inputs and internal state variables.

This logic is called rules and can be managed from the *Rules* menu.

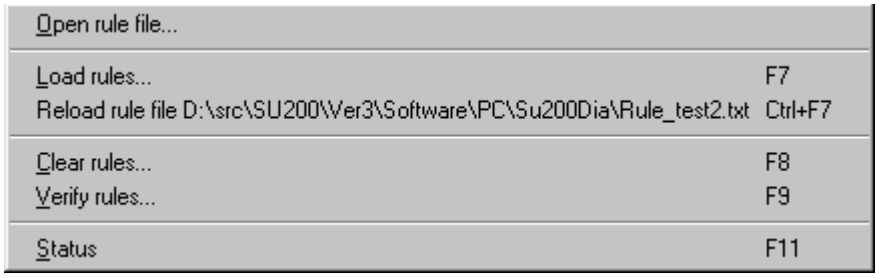

Figure 41 - Rules menu in SU200DIA

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Menu	*Function*
Load rules	Load rules defined in a text-file into SU200. The use is prompted for a file with default extension `TXT`. The file is syntax-checked and compiled. Any semantic errors are reported both in a window and in a generated report-file. If the rules are correct, the compiled program is downloaded to SU200.
Reload rule file ….	Reloads the last loaded rule-file (SU200DIA will save the name of the last loaded rule file and use that name at the next start).
Clear rules	Clear all rules in SU200. (any relays controlled by the rules are opened)
Verify rules	Basically the same function as Load rules, except that the rules in a text-file are compared with the rules currently programmed into SU200.
Rule status	Indicates if SU200 has a rule program or not.

Table 10 - Rules menu in SU200DIA

All rules are compiled to a single program in machine code by SU200DIA. This allows the fastest possible evaluation of the rules. The size of the rule-program is limited to 1024 bytes.

The interpretation of the rules is carried out at by SU200 at power-up and cyclic every 4 ms. during normal operation.

The relays controlled by the rules can not be controlled from the fieldbus master.

The rules defines logic which may be performed on:

- Signal levels of all digital inputs
- Internal state variables in SU200

For digital inputs specified in the rules, the following apply:

- Any digital input channel (1-40) may be specified
- Signal transitions are recognised without any delay at all.
- The applied dead and filter-time parameter for the channel is not used when the rule is evaluated.
- The logic level (positive or negative) parameter for the channel is not used when the rule is evaluated.

The following state variables may be used in the rule logic:

State variables	*Description*
1	SU200 healthy Set to “1” if all the following conditions are true: • Memory OK (RAM, EEPROM) • The internal hardware watchdog has generated no reset. • Both power supplies are functioning. • The time synchronisation signal is correctly received within 30-minute time windows. Note: Writing to this state variable in the rule program, will only change the variable for a max. of 4 ms., as the state variable is updated by a 4 ms. firmware cycle.

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2	(In firmware version older than V3.00, this state variable is fixed set to 0). Set to "1" if the message buffer overflows. This happens when 500 unsent messages are stored in the message buffer and a new signal message is raised (not system message). This state variable can be reset clicking the *LED-TEST* button. However, if a message condition is present, the state variable will be immediately set since the message buffer isn't cleared when the *LED-TEST* button is pressed. Following a *LED-TEST* button press, any set alarms are re-reported.
3	(In firmware version older than V3.00, this state variable is fixed set to 0). As state variable S2,except that this state variable is never reset.
4-128	Can be used in programming of rules.

Table 11 - State variables in rules

SU200 will verify the rule program at power-up and after download by means of a 16-bit checksum. A system alarm is generated in case of checksum error.

The rules may be tested by means of simulating the inputs.

The level of the outputs controlled by the rules can only be overridden -setting by the local control mode.

No indication is sent to the central control station when an output is set, reset or blocked due to a rule.

The following types of function blocks can be programmed:

Function	*Description*
SET	Set an output automatically when a programmable condition is TRUE.
RESET	Reset an output automatically when a programmable condition is TRUE.
BLOCK	Block any changes to an output when a programmable condition is TRUE.
ENABLE	Enable changes to an output only when a programmable condition is TRUE.
AENABLE	Set an output when this is requested by the master and a programmable condition is TRUE (in all other cases the output is reset).
ABLOCK	Set an output when this is requested by the master and a programmable condition is FALSE (in all other cases the output is reset).

Table 12 - Rule function types

6.3.7.1. Example of rules:

```
SET O1 = I1 & I2 | (!I3 & (I4 ^I40))
SET O1 = S1
BLOCK O24 = I1 & I2
RESET O24 = I1 & I2
ENABLE O24 = I1 & I2
AENABLE O24 = I1 & I2
ABLOCK O24 = I1 & I2
; THIS IS A COMMENT
SET S128 = S1 ; THIS IS ALSO A COMMENT
IF S1
      SET O1 = 1
      SET O1 = 0
ELSIF S2
      SET O2 = 0
      SET O2 = 1
ENDIF
```

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6.3.7.2. SET function

If the rule evaluates to TRUE, the specified output will be set.

Any reset-order received from the master is ignored.

The specified output will be set as soon as the rule evaluates to TRUE.

If the input condition evaluates to FALSE, the current output order will be applied to the output.

6.3.7.3. RESET function

As the SET function except that the specified output is reset.

6.3.7.4. BLOCK function

While the rule evaluates to TRUE, the specified output is frozen. No new output orders are accepted, the output will remain in whatever is the current position (at power-up, this is OPEN). Any reset-order received from the master is ignored.

The current output order will be applied as soon as the rule evaluates to FALSE.

6.3.7.5. ABLOCK function

While the rule evaluates to FALSE, the master output (0/1) is enabled..

While the rule evaluates to TRUE, the specified output is reset.

6.3.7.6. ENABLE function

While the rule evaluates to FALSE, the specified output is frozen. No new output orders are accepted, the output will remain in whatever is the current position (at power-up, this is OPEN). Any reset-order received from the master is ignored.

The current output order will be applied as soon as the rule evaluates to TRUE.

6.3.7.7. AENABLE function

While the rule evaluates to TRUE, the master output (0/1) is allowed.

While the rule evaluates to FALSE, the specified output is reset.

6.3.7.8. Rule file macros

In order to avoid directly addressed input/output signals in the rule functions, i.e. `SET O1=I1&I2` a macro function can be used.

Macros are defined using the syntax:

```
DEFINE <macro> <text>
```

`<macro>` A token which may consist of one or more alphanumeric (letters and digits) characters terminated by a space (e.g. the "_" character can not be used in macro-names).

Any occurrence of the word given by <macro> in the rule file will be replaced by <text>. Macro definitions are however not recursive. Any text following after a DEFINE statement will not be evaluated using the macro substitution.

`<text>` Text that will replace <macro> in the source rule file. The text may be a single non-alphanumeric character ("&", "(", "!", ...)

The following is a legal fragment of a rule file:

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```
DEFINE DEF DEFINE
DEF AND &
DEF INPUT1 I1
DEF INPUT2 I2
DEF OUTPUT1 O1
SET OUTPUT1 = INPUT1 AND INPUT2
```

The last line will be translated to:

```
SET O1 = I1&I2
```

The following are NOT legal:

```
DEFINE A B
DEFINE A B
```
Macro 'A' defined twice.

`DEFINE A B C` Too many tokens (3)

`DEFINE A` Too few tokens (1)

`DEFINE AND &!` Too many tokens (3)

6.3.7.9. Actions when communication with active master is interrupted

Normally SU200 resets all outputs when the communication with the active master is interrupted. Outputs controlled by rules are however specially handled:

Function	*Action*
`SET`	Always set/reset depending on the rule (master has no control).
`RESET`	Always set/reset depending on the rule (master has no control).
`BLOCK`	Frozen to the output level before the communication failure if the rule evaluates to TRUE. Reset if the rule evaluates to FALSE.
`ENABLE`	Frozen to the output level before the communication failure if the rule evaluates to FALSE Reset if the rule evaluates to FALSE.
`AENABLE`	Always reset, no matter what the rule evaluates to.
`ABLOCK`	Always reset, no matter what the rule evaluates to.

Table 13 - Actions on communication interrupt for rule functions

6.3.7.10. Override rule control in local mode

In local control activated from SU200DIA, the outputs can be controlled no matter rule programming. When local control is deactivated, the rules will again apply.

6.3.7.11. Rule download report

Whenever a rule-program is downloaded to SU200 (using *Load rules* or *Verify* rules) a report file is generated. The report file will have the extension `LST`, i.e. when a file named `rules.txt` is downloaded; a report-file named `rules.lst` is generated.

6.3.7.12. Priority

The rule program compiler does not check if an output is specified more than once. E.g. the following rule program is accepted:

```
SET O1 = I1 & I2
```

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```
RESET O1 = I1 & I2
```

If the above rule program is downloaded and both input `I1` and `I2` has a high level, SU200 will reset the output (because the `RESET` rule appears after the `SET` rule).

In general: If an output is specified in more than one rule, only the last specified rule with the output will be "active", since it is evaluated after the other rules.

6.3.7.13. Rule file syntax

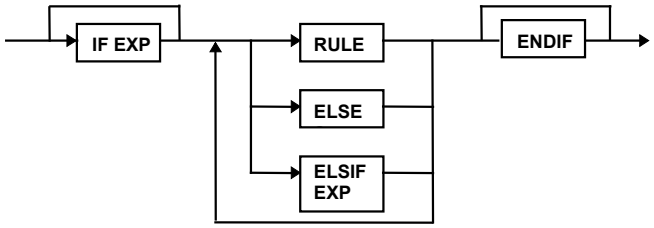

Figure 42 - Rule file syntax – flow control

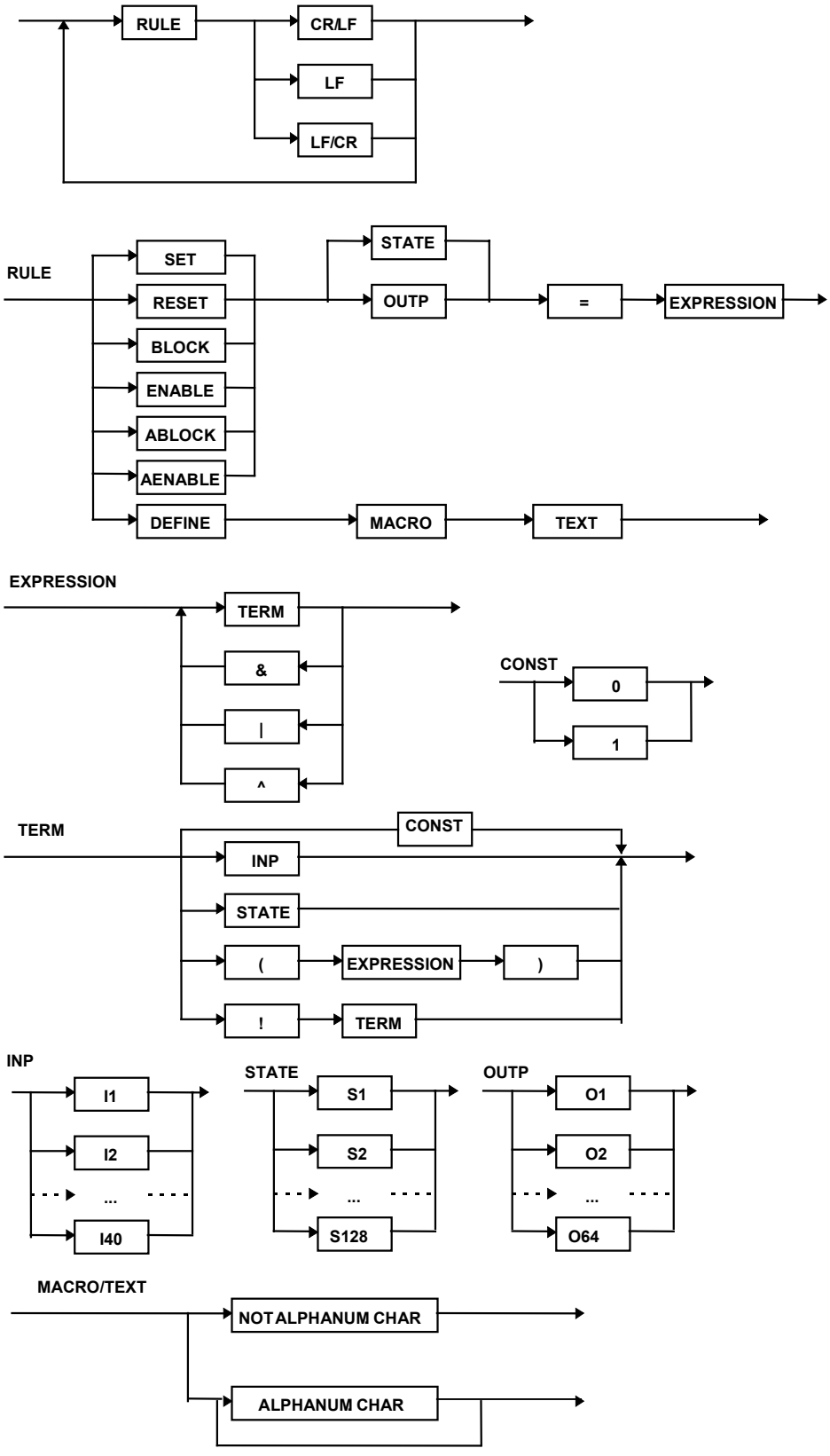

Figure 43 - Rule file syntax - continued

Notes:

Space, tab, form-feed and carriage return are ignored (ASCII 0x09 - 0x0D and 0x20).

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O1-O24 refers to output channels.

I1-I40 refers to input channels.

S1-I128 refers to state variables (static memory bit variables)

After “I” or “O”, leading zeroes are ignored. E.g. I001, I01 and I1 are equal.

& = AND | = OR ^ = XOR ! = NOT

6.3.7.14. Rule file example

```
DEFINE DEF DEFINE
DEF AND &
DEF OR  |
DEF NOT !
DEF XOR ^
DEF EQ  =

DEF BL BLOCK
DEF EN ENABLE
DEF RES RESET
DEF INPUT1  I1
DEF INPUT2  I40
DEF INPUT3  I12
DEF OUTPUT1 O24

ABLOCK O1 = I1 & I2 | (I3 ^ (I4 & I5))
SET O24 = I1 & I2
RESET O1 = I39 & (!I40 |  I1)
SET O24    =I1&I40
SET OUTPUT1=INPUT1 AND INPUT2

RES OUTPUT1=INPUT1 XOR INPUT2
RES O24    EQ I1^I40
EN  OUTPUT1=INPUT1 OR INPUT2
BL  OUTPUT1=INPUT1 OR NOT INPUT2
SET OUTPUT1 EQ INPUT1
SET O24     =  I1
SET OUTPUT1 EQ INPUT1 OR (INPUT2 AND INPUT3)
SET O24     =  I1     |  (I40    &   I12)
SET O24      = I1 | I40 AND NOT I12
SET O24      = I1     OR I40    AND NOT I12
```

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More examples

```
;-------------------------------------------------------------------------
; EXAMPLE OF LATCH PROGRAMMING
;-------------------------------------------------------------------------

; ***** PSEUDOCODE *****
;
; IF (I1 | I2 THEN
;      SET Saved = I1
; ENDIF
; SET O1 = Saved
;
;

; Input which is latched on output
DEFINE L1LatchInput         I1

; Input which enables latch to be updated (no matter level on inputs)
DEFINE L1UpdateLatchInput   I2

; Latched output
DEFINE L1LatchedRelay       O1

; Saved state of latch
DEFINE L1LatchedState     S128

; Latch can be updated when input is high, or if update signal is high
IF L1LatchInput | L1UpdateLatchInput
   SET L1LatchedState = L1LatchInput     ; Save state of latch
ENDIF

SET L1LatchedRelay = L1LatchedState      ; Use saved state of latch
```

6.3.8. Communication

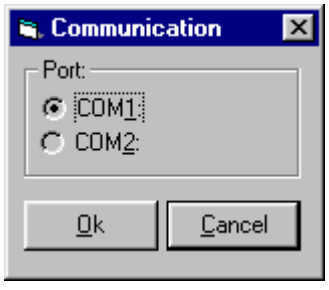

Figure 44 - Setting communication port in SU200DIA

Select communication port on PC that is connected to the serial service interface of SU200. The setting will be used for subsequent starts of SU200DIA.

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6.3.9. Firmware tool

The firmware tool is a separate application that can be started from SU200DIA.

The tool enables the user to:

- Read/write physical memory
- Read/write I/O ports
- Download firmware to SU200

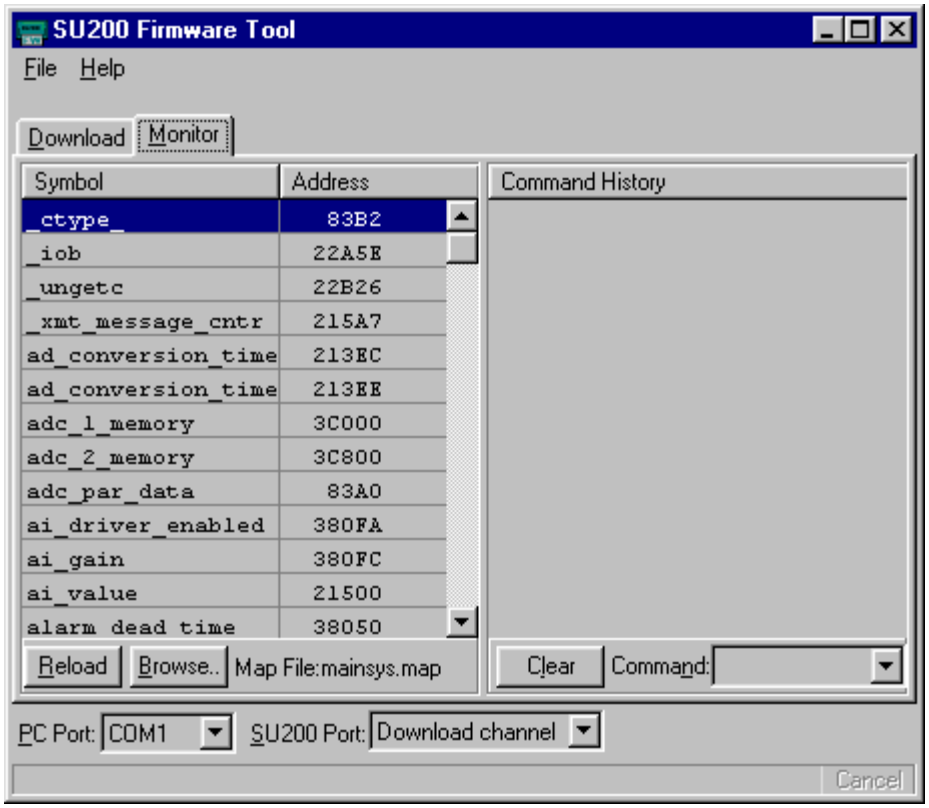

Figure 45 - Firmware tool

SU200DIA is suspended while the firmware tool is running.

The firmware tool can be used when the PC is connected to any of the two serial interfaces of SU200

- Service channel for reading/writing memory or I/O-ports
- Download channel for reading/writing memory or I/O-ports as well as downloading new firmware

All communication ports on the PC can be used.

6.3.10. Reading/writing memory or I/O-ports

Warning

Direct access to firmware memory or ports may cause SU200 to hang. Parameter values and rules can be overwritten.

Select the *Monitor* page of the main window.

Commands are entered in the *Command* control. Results of commands are shown in the *Command History*

list. The list can be printed.

Symbolic commands can be given using symbols in the left list-field. These symbols are found in the `MAP` file shown below the list-field. The *Browse* button can be used to select another `MAP` file. The symbol list can be printed.

Example of commands:

Command	Description
`Reset`	Software reset of SU200
`Hex`	Show values in hexadecimal number system.
`Dec`	Show values in decimal number system.
`BYTE 0`	Read byte at address 0
`BYTE 0 LEN 10`	Read 10 bytes from address 0
`UINT 10000`	Read 16-bit word at address 10000
`Integer 0 len 10`	Read 10 16-bit signed integers at address 0
`Long 100000`	Read signed 32-bit long at address 100000
`Port 1`	Read I/O port 1

Figure 46- Monitor commands in firmware tool

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6.3.11. Downloading new firmware

Warning

The download of a new firmware is not a 100% secure process. Any unexpected failure during the download, e.g. a power-down or PC failure may cause the download to stop. In this case, the main flash memory devices in SU200 must be replaced as described in Appendix D.

Special procedures may be required to perform a firmware upgrade without changing the SU200 operating parameters. This procedures depends on the firmware version. A safe procedure would be to use SU200DIA to upload/save parameters prior to the download, then re-apply these parameters after the download has been completed.

- Copy the firmware files - `mainsys.map and mainsys.hex -` to the same folder as the firmware tool (`FirmwareTool.exe`). For most installations, this is `C:\Program Files\Siemens AS\SU200`
- SU200 system software must be installed on the PC. Connect the PC to the serial download interface of SU200, see Figure 47.

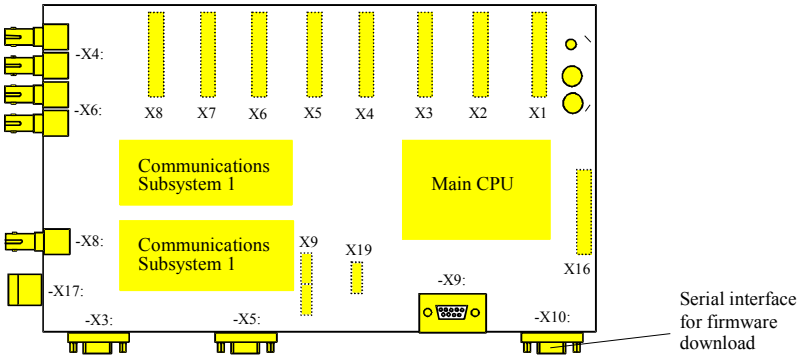
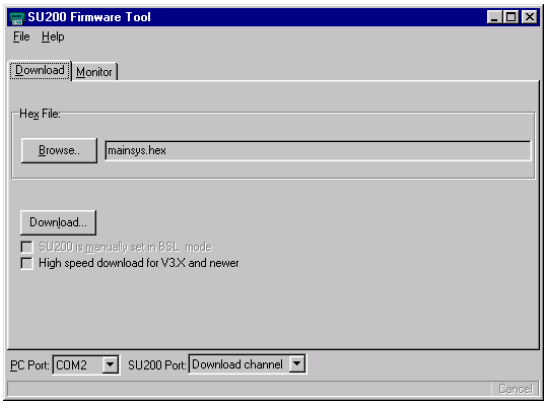


Figure 47 - Serial port used for firmware download

- Disconnect both PROFIBUS interfaces of SU200 (not required if version 3.40 or later are installed)
- Start SU200DIA and select *Firmware tool* on the *Tools* menu - or : Start the firmware tool directly from the Windows Start button through menu *SU200 | Firmware Tool (Download channel)*.
- Select PC communication port. The checkbox *High speed download for V3.X and newer* can optionally be checked if SU200 does contain firmware of version 3.00 or newer. This option provides a faster download.



- Download firmware clicking the *Download* button. Observe the progress of the download in the lower right corner. Do not operate SU200 while the firmware is being downloaded.

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7. Installation

Warning

The successful and safe operation of this device is dependent upon proper handling and installation by qualified personnel under observance of all warnings and hints contained in this manual.

7.1. Unpacking

When dispatched from the factory, the equipment is packed in cardboard in accordance with the relevant guidelines of packaging (e.g. protection against mechanical shock).

The packing should be removed with care, without force and without the use of inappropriate tools. The equipment should be visually checked to ensure that there are no external traces of damage.

If SU200 is already installed in panels or cubicles and transported with them, the conditions stated must be observed likewise.

After the equipment has been unpacked, the data on the nameplate must be compared with the delivery note and the labelling on the packing. In particular, the auxiliary voltage and rated values for input and output must be checked against the plant data.

Note: The units are supplied with degree of protection IP20. During transport and installation, moisture condensation and contamination are not permissible.

7.2. Mounting

SU200 is designed for surface mounting on standard subrack frames or for cubicle mounting. For the mounting on subrack frames, a mounting bead with 4 slots is provided on both sides of the housing front.

The unit is fixed to the frame with 8 screws.

For cubicle mounting, a mounting bead with 3 slots is provided on the top and bottom side of the housing back. The unit is fixed with 6 screws.

See chapter *Dimensions* for specification of dimensions.

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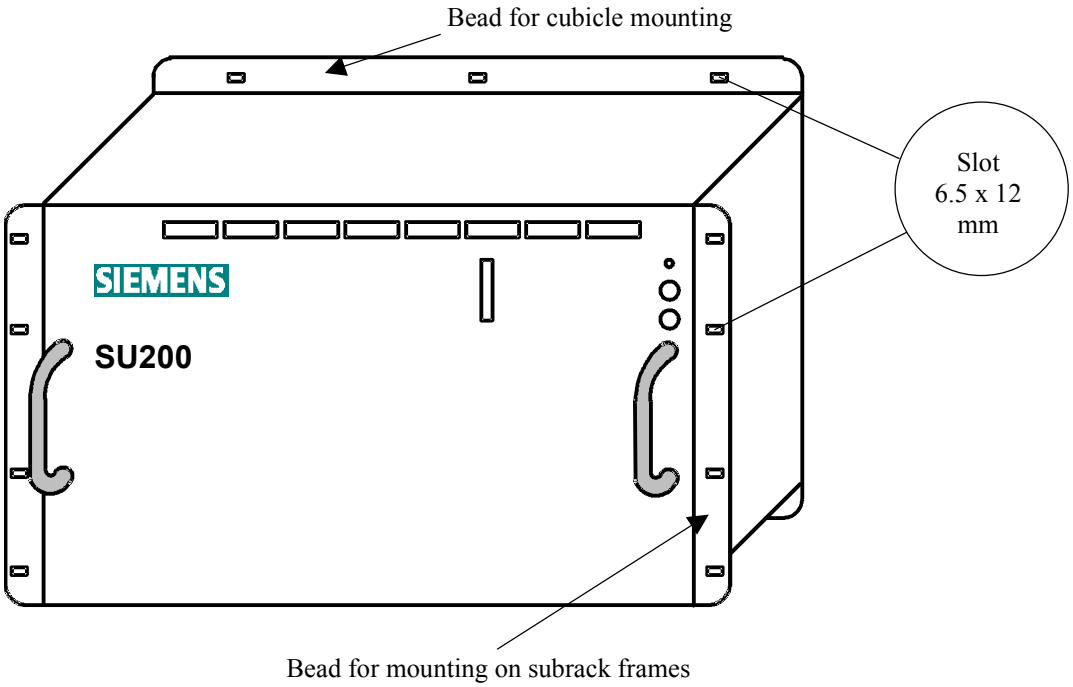

Figure 48 - Mounting beads

7.3. Connection

7.3.1. Earth connection

A solid low-ohm and low-inductive operational earth connection is to be made between the earthing system of the cubicle and the housing of SU200. Therefore, 2 threaded bolts M6 are provided on the front bead at the bottom side of the housing.

7.3.2. Connection of control wires

- All external wires are connected via plug-and-socket connectors.
- For the digital input, 9-pole plugs are provided.
- For the command output and analogue signal input, 6-pole plugs are provided.
- Another common 6-pole plug is provided for the redundant power supply and the electrical time synchronisation input.

All plugs for signal input and output are designed with 4 mm^2 screw terminals. For the analogue input, plug connectors with 2.5 mm^2 screw terminals are provided.

The connection is done in accordance with the associated circuit and connection diagrams.

The labelling of the individual connectors must be observed and must match with the designation of the associated base sockets to ensure correct location.

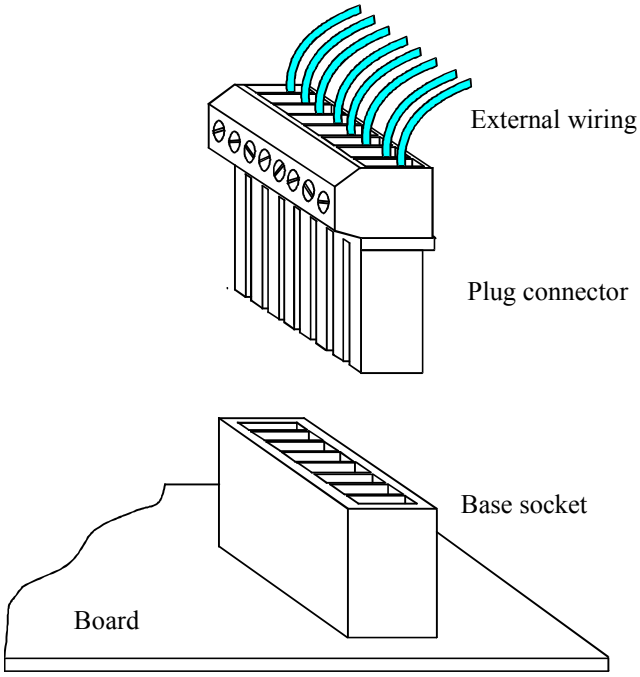

Figure 49 - Plug-and-socket connection of external wiring

7.3.3. Connection of optical data lines (fieldbus)

5 optical bus terminals with bayonet coupling are provided on the CPU for connection of the fibre optic cables.

For the redundant fieldbus connection, 2 receiver and 2 transmitter ports are provided and designed to operate with 62.5/125 µm fibre optic cable. Another receiver is provided for the optical time synchronising signal input.

The receivers are easily identified by their dark grey colour; transmitters are made in light grey colour.

Since each connection is used for one data transfer direction, the transmitter at SU200 must be connected to the receiver of the central control station and vice versa.

The fibre optic cables must be assembled with appropriate ST connectors (industry-standard).

During storage and transportation, the cables must be kept sealed with appropriate protective caps at each end. During installation, the specified bending radii and tensile stress must not be exceeded.

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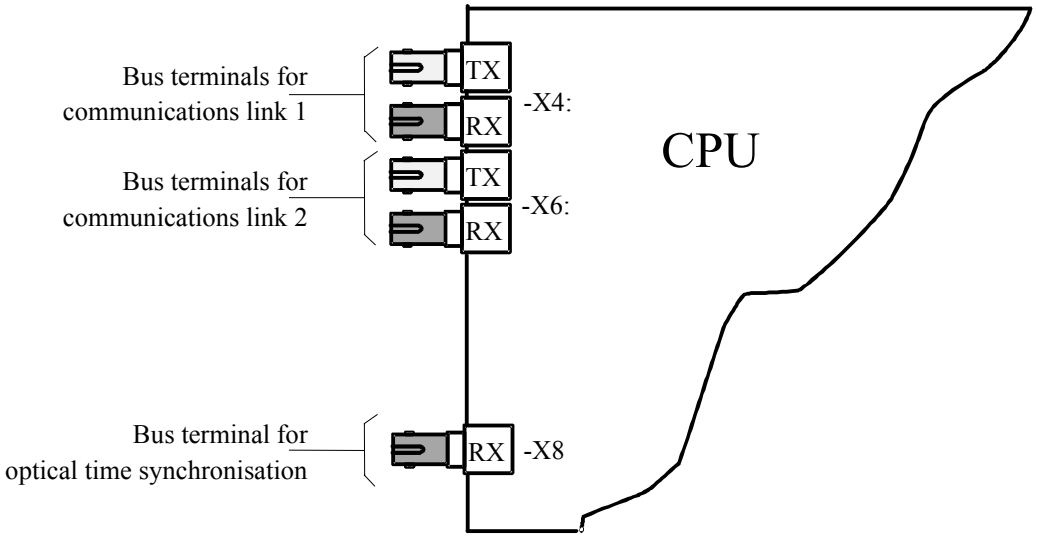

Figure 50 - Optical bus terminals

Warning

The small junction size inherent to the design of these components increases the component susceptibility to damage from electrostatic discharge (ESD). It is advised that normal static precautions be taken in the handling and assembly of these components to prevent damage.

7.3.4. Connection of electrical data lines (fieldbus)

In addition to the bus terminals for the connection of an optical bus link, 2 SUB-D jacks are provided on the CPU for the connection of a redundant electrical fieldbus link.

For the connection of the shielded data lines, appropriate bus connecting plugs with cable outgoing from the side must be used (for ordering data refer to chapter *Ordering data*).

The cables must be kept sealed with a shrink-on cap at each end during storage, transportation and installation. During installation, the specified bending radii and tensile stress must not be exceeded.

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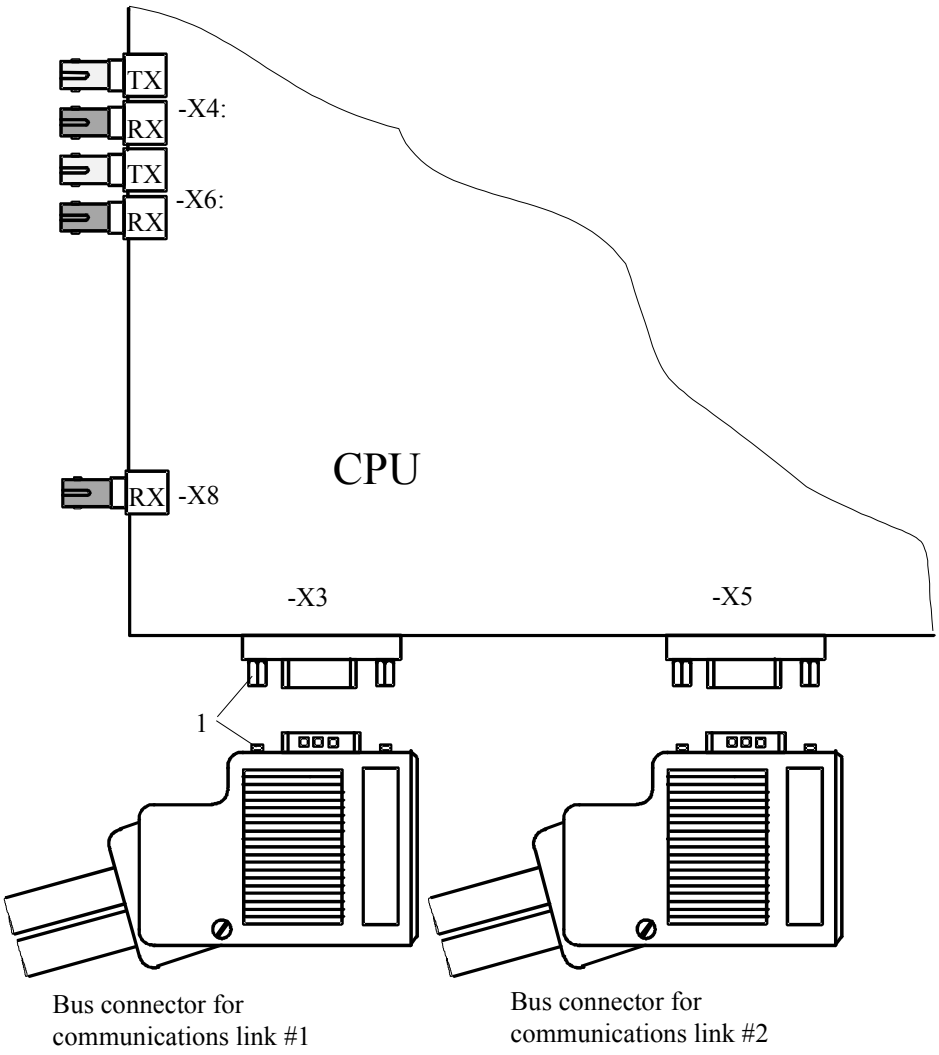

Figure 51 - Connection of electrical data lines

It must be ensured that both bolt-on fixings of the bus connector are tightened in order to achieve a proper chassis earth connection and, thus, to increase the HF interference immunity.

For the connection, the cable insulation must be stripped and the two cores inserted and connected to the internal screw terminal block (terminal A and B) of the bus connector. The cable sheath must be pressed between the two cable clips.

In order to prevent circulating currents flowing across the screen, the cable screen shall be earthen at one line end only.

It must be ensured that the same cores are always connected to the same terminal A or B at both sides of the cable (standard cables are designed with a green and a red core).

Various bus connectors are designed with a second input circuit, for connection of further nodes on the fieldbus in a line configuration.

The bus connection of the first and last node of the bus can be either on the left or on the right of the connector.

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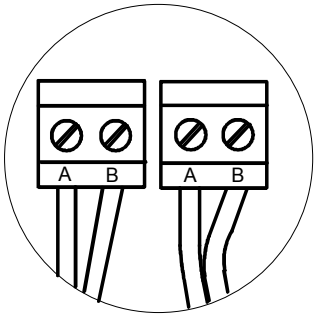

Figure 52 - Terminal arrangement of bus connector

The last node on the fieldbus must be connected via a termination resistor. Therefore, the built-in termination resistor of the respective bus connector shall be set active by means of an ON/OFF switch on the plug chassis.

A termination resistor is also provided internally on the CPU and can be activated via DIP switch 1 at the underside of the CPU module.

SU200 unit is delivered with the termination resistor for the electrical bus link set to inactive. This setting is normally not to be changed on site.

The termination resistor can be activated with all switches of DIP switch 1 set to ON.

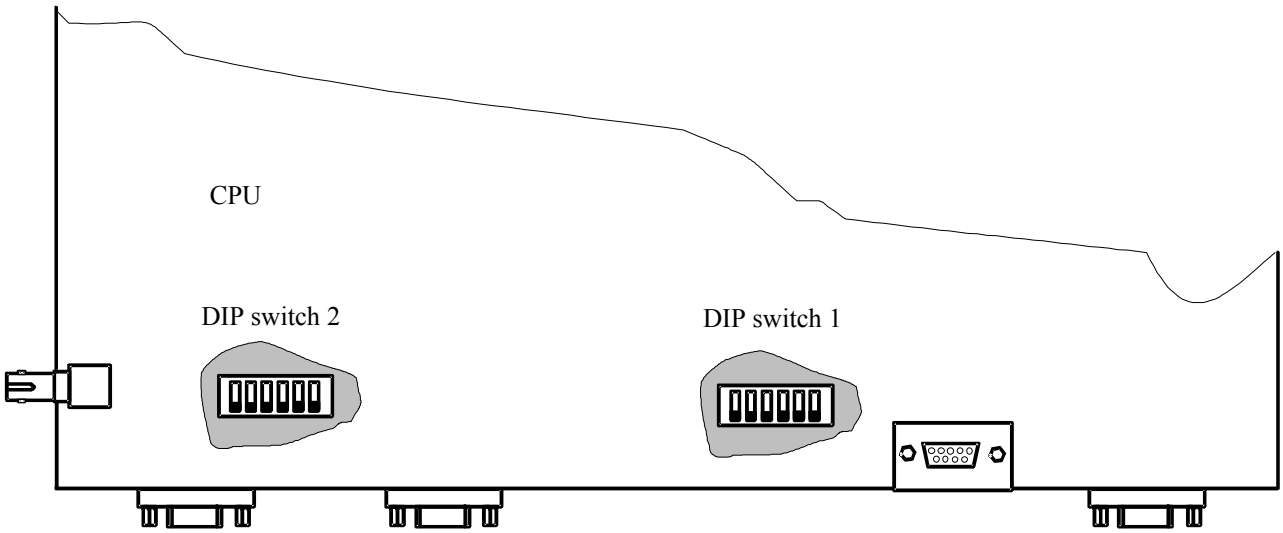

Figure 53 - Allocation of CPU DIP switch 1 and 2

DIP switch 2 is provided at the underside of the CPU module and serves for the configuration of the serial parameterisation and diagnostics interface.

SU200 unit is delivered with the parameterisation and diagnostics interface set to RS-232 transmission standard (V.24 / V.28).

Figure 54 shows the delivery configuration of CPU DIP switches.

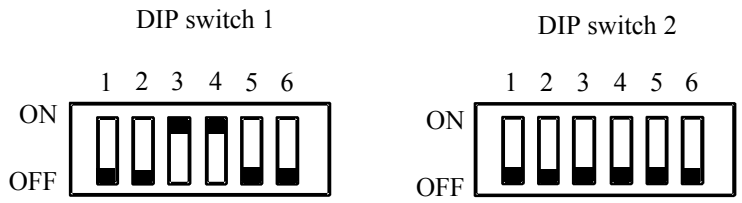

Figure 54 - Delivery configuration of CPU DIP switches

7.3.5. Cable entry fitting

For the cable entry, the underside of SU200 is designed with edge-protected comb chases on both sides of the housing.

At the inside of the chases, a cable clamping is provided to serve as a slipping lockout. Additionally, a screen clamping is provided for shielded cables (analogue value input, electrical fieldbus lines).

It is recommended to lay a maximum of 9 cores (e.g. 1.5 mm^2 wires) in one slot of the comb chase.

Figure 55 shows the principle arrangement.

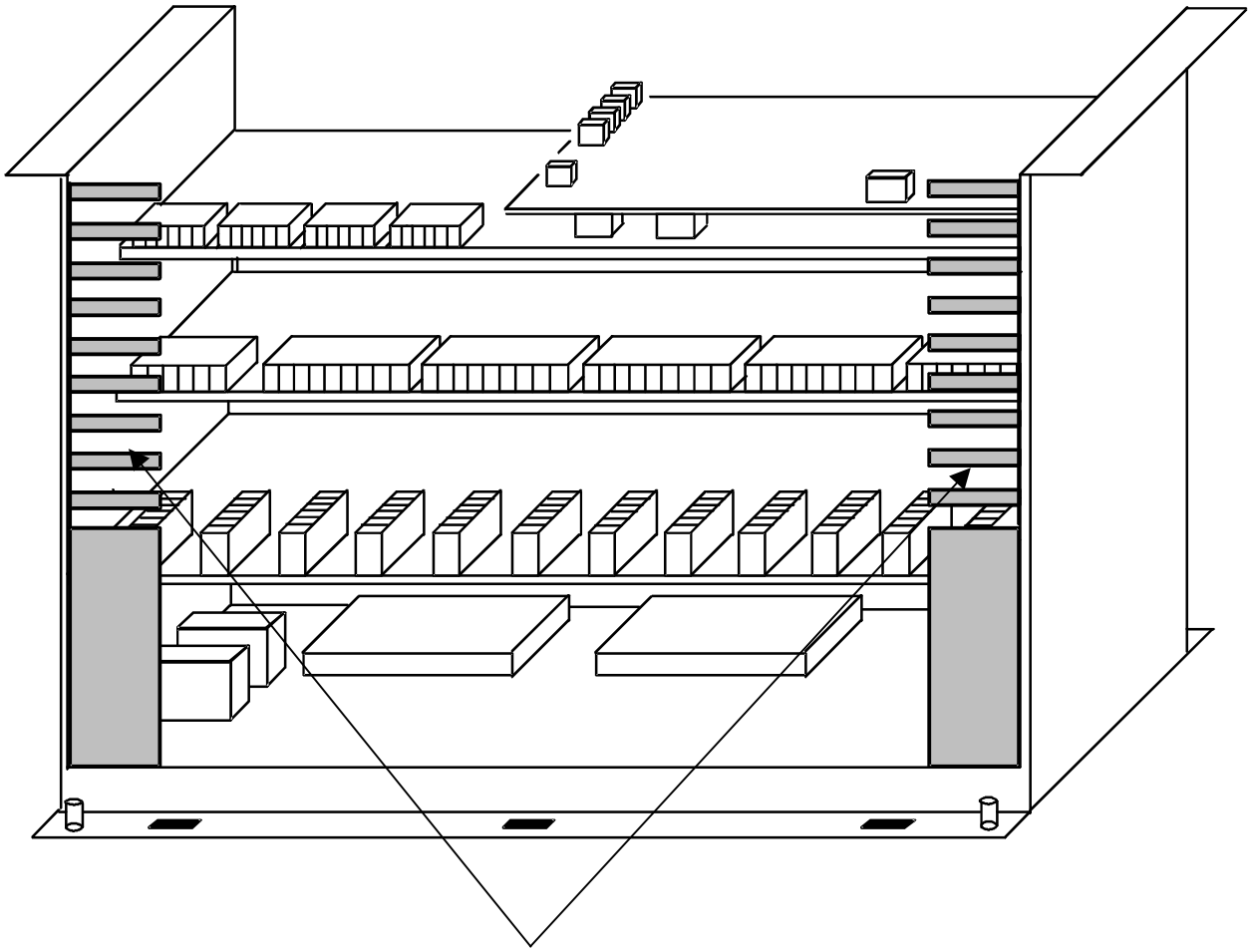

Figure 55 - Cable entry of SU200

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7.3.6. Connecting points

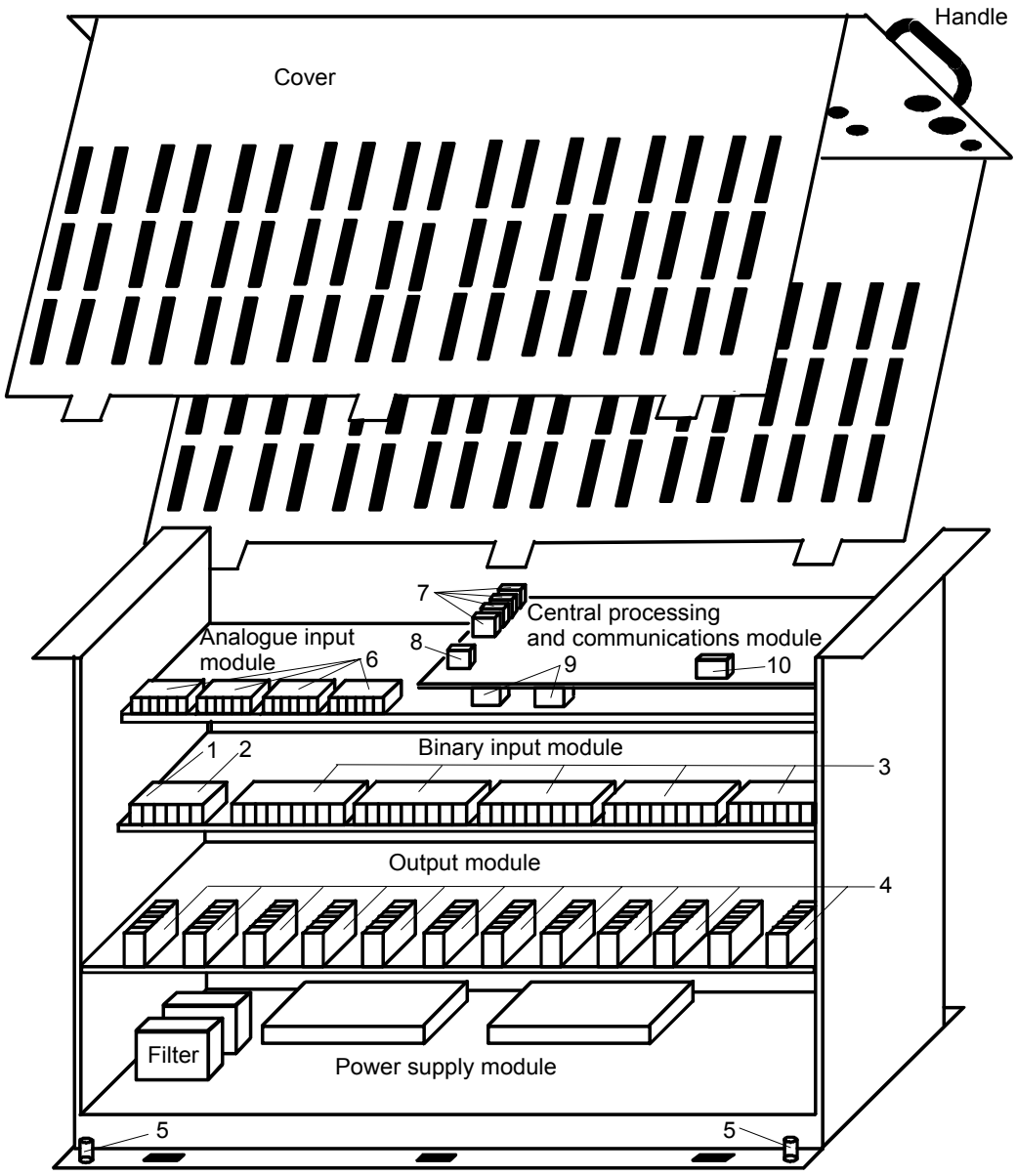

Figure 56 - Connecting points of SU200

1. Connector for electrical time synchronising signal input
2. Connector for auxiliary power supply
3. Connectors for digital input
4. Connectors for command output
5. Connecting bolts for protective earth
6. Connectors for analogue input
7. Connecting ports for fibre optic fieldbus cables
8. Connecting port for optical time synchronising signal input
9. Connecting ports for electrical fieldbus cables
10. Connecting port for parameterisation and diagnostics data line

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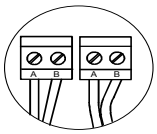
8. Commissioning



Warning

During operation of electrical equipment, hazardous voltages are present. Non-observance of the safety instructions can result in severe personal injury or property damage.

Only qualified personnel should work on this equipment. These personnel should be thoroughly conversant with the relevant safety measures and the warnings contained in this manual.

Note in particular that:

- The equipment must be properly earthen before connecting any cables.
- Hazardous voltages may still be present after the auxiliary power supply has been disconnected or switched off (electric charge).

8.1. General

Prior to the commissioning, check that the order number shown on the nameplate matches with the intended application.

Under certain circumstances it might be useful to carry out the functional checks of SU200 in the course of the commissioning of the secondary circuitry of the process, i.e. during checking the interaction between SU200 and the connected process (e.g. switchgear).

An industrial standard PC is part of commissioning tools and allows, just as an operator panel, all necessary settings, read-out of data and initiation of command output with the added comfort of visualisation and menu-guided procedure.

SU200 is ready to operate when the required operational parameters have been entered. Parameterisation is done by subsequent entering of settings or by downloading all parameters from a parameter file.

8.2. Checking the auxiliary power supply

Prior to the function tests of SU200, the auxiliary power supply circuits are to be tested for correct polarity and fusing.

After closing the m.c.b. of power supply circuit 1, the voltage magnitude is measured at the input terminals.

The unit starts up and after completion of the run-up period, indicated via a short-time flashing of the upper 40 LED‘s, it must be checked that LED #1 (*OPERATION*) and LED #2 (*POWER SUPPLY*) of SU200 light up accordingly.

Subsequently, the aforesaid steps must be repeated with power supply #2 only, see chapter *LED display*.

8.3. Checking the fieldbus link

The communications interface with the central control station(s) is to be checked for proper connection. For optical bus links, the allocation of transmitter and receiver channels is to be checked.

Electrical bus links must be checked for correct polarity of the inner conductors and for proper treatment of the cable screen.

After putting the central control station(s) into service, it must be checked that the respective LED on SU200 (*INTERFACE* 1 and *INTERFACE 2*) light up and, thus, indicate healthy data transfer.

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8.4. Checking the clock control and time synchronisation

8.4.1. Checking the clock control

Prior to putting the fieldbus link(s) into service, the internal clock control of SU200 is initially checked by way of fetching the message log of SU200 using SU200DIA application.

After SU200 start-up, the system message S101 is generated and logged as shown below.

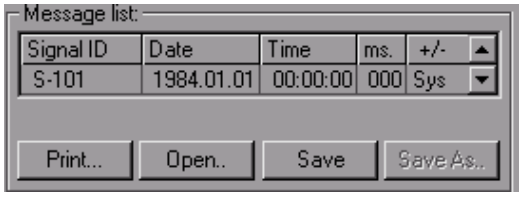

Figure 57 - System message 101, SU200 time not yet synchronised

In order to check the internal clock control of SU200, the communications interface with the central control station(s) is then put into service.

Subsequently it is to be checked, that the internal clock is set with the advance time (lead-time) received via the first telegram from the central control station and the time mark of S-101 is corrected accordingly.

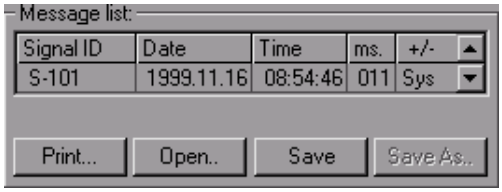

Figure 58 - System message 101, SU200 time has been synchronised

8.4.2. Checking the time synchronisation

A trigger signal is to be simulated on both interfaces by way of applying an appropriate voltage signal to the electrical synchronisation input and connecting the optical signal input. In each case correct function is indicated via LED #39.

In order to check correct clock control and time tagging, a process message should be generated by way of simulating a status change on a digital input at a definite time. Subsequently, the message log of SU200 should be read and checked for correct time tagging.

8.5. Checking the digital input

After completion of the cabling, the digital input is tested by way of subsequent initiation or simulation of the input signals at a suitable point and by checking the correct response of SU200 with regard to:

- Correct acquisition and channel association
- Correct LED display
- Correct status image processing
- Correct generation of process messages

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8.6. Checking the command output

After completion of the cabling, the command output is checked by way of giving respective commands either from the central control station or by means of SU200DIA application.

In doing so, the proper function is tested by checking the correct response of the associated connected devices (high-voltage switching devices, control and protection units). At the same time, the corresponding LED display on SU200 must be checked.

8.7. Checking the analogue inputs

After completion of the cabling, the analogue inputs are tested by simulating the respective measured variables at a suitable point (either at the input terminal of SU200 or preferably at the external measuring transducer or transmitter). Check the correct response and data pre-processing of SU200 with regard to:

- Correct acquisition and channel association
- Correct conversion and transmission
- Correct conversion into percentage values for diagnostics

The simulation of analogue inputs can be done using an appropriate secondary test set.

8.8. Checking the self-monitoring function

Table 14 describes all system messages and how this messages can be generated. The individual system messages can be read from the message log of SU200 using SU200DIA application.

System message		*Description*	*Testing procedure*
S-101		Unit start-up	Operate the RESET button
S-102		Time synchronising trigger signal missing	Disconnect time synchronisation input for a period of 30 minutes
S-103		Message buffer overflow	Disconnect communication link to the central control station and simulate more than 500 status changes on the digital inputs
S-104		Power supply #1 failure	Switch off power supply circuit 1
S-105		Power supply #2 failure	Switch off power supply circuit 2
S-106		CPU-RAM failure	Factory-tested
S-107		EEPROM failure	Factory-tested
S-108		Watchdog failure	Factory-tested
S-109		Communications interface #1 internal failure	Factory-tested
S-110		Communications interface #2 internal failure	Factory-tested
S-111	⊗	Communications interface #1 out of service	Disconnect fieldbus link 1
S-112	⊗	Communications interface #2 out of service	Disconnect fieldbus link 2
S-113		Analogue input card faulty	Disconnect cable to analogue input card (while power is off). Power up. Make sure that the AI is enabled, otherwise no error message will be generated.
S-114	⊗	Power supply #1 healthy	Disconnect power supply.
S-115	⊗	Power supply #2 healthy	Disconnect power supply.
S-116		Time synchronising trigger signal received	Apply high signal to time synchronisation input after more than 30 minutes since last signal.
S-117		Rule program invalid	Factory-tested Use firmware tool and give command: INT 18002=0. Apply a reset
S-118		FLASH memory write failure	Factory-tested Use firmware tool and give command: INT 10000=FFFF
S-146		Local control mode actuated	Activate local control mode

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S-147	Remote control mode actuated	Deactivate local control mode
S-1....12	Relay group 1....12 faulty	Factory-tested

Table 14 - Testing system messages

⊗ Correct LED indication under specific fault conditions should be checked.

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9. Maintenance and fault tracing

SU200 does not require any special maintenance. The unit is completely static and the internal automatic self-test routines ensure permanent self-monitoring and systematic error detection and alarm indication in good time.

If a hardware or firmware fault is detected as a result of these test routines, SU200 must be returned to the manufacturer for repair or exchange.

Local repair of modules is not permissible.

Exceptions to this rule require the agreement of the manufacturer.

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Appendix A SU200DIA Parameter-files

The files used to store parameters for SU200 has extension `PAR`. The content is in ASCII-format. The 10 first lines in the files are common parameters, the next 40 lines contains parameters for each of the alarm channels.

Whitespace are used to separate parameters in lines with multiple parameters. The lines are terminated by LF, CR or CR/LF (LF=Line Feed, CR=Carriage Return).

Line	*Description*
1	PROFIBUS station-address (range 1-125)
2	Not used, set to 0
3	Not used, set to 0
4	Not used, set to 0
5	Master Mode 0=Dual Masters 1=Single master #1 2=Single master #2
6	Analogue input enabled 0=Disabled 1=Enabled
7	Not used, set to 0
8	LED indication 0=Indicate alarms 1=Indicate physical signal level
9	Not used, set to 0
10	Not used, set to 0

Table 15 - Parameter file format - General section

The next 40 lines are lines with parameters for every single alarm input channel. The lines contains several parameters:

Field	*Description*
1	Channel-number Sequentially numbered from 1 to 40 (the first line has channel number 1, the last line has channel number 40).
2	Signal ID 0=No alarm message for this channel 1-65535=Unique signal ID for the channel (Note: two channels can not have the same signal ID)
3	Dead time (range 1-255)
4	Filter time (range 1-255)
5	LED 0=Storage mode (press lamptest to switch off a lit LED) 1=Follow mode (LED indicates current logical/physical signal level)
6	Logic 0=Negative 1=Positive
7	Mode 0=Normal mode 1=Impulse counter
8	Time-unit for dead- and filter-time 0=ms. 1=10ms. 2=1s. 3=10s.
9	Not used, set to 0

Table 16 - Parameter file format - Digital input signals section

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The next 34 lines are lines are used in versions later than 3.40. The lines contains several parameters:

Line	*Description*
1	V3.40 This field is a mandatory identification signalling that more parameters will follow
2 - 9	8 AI gain values (range –4096 to 4095)
10-33	Fail-to-safe mode for each of the 24 relays. One line per relay. 0= Open relay (normal) 1= Keep relay in current position

Table 17 - Parameter file format - Extended section for versions later than 3.40

Notes:

- Out-of range values for parameters will cause a communication error message to be given when parameters are written to SU200.
- The value of the *Signal ID* field must be unique. Thus, two channels can not have the same value for this parameter. Exception: The value ”0” is allowed for more than one channel. Violating this restriction will cause a communication error message to be given when parameters are written to SU200.
- Unused lines/field must be set to ”0”.

A special parameter-file located in the Windows directory and named SU200COM.PAR are used by SU200DIA itself to store parameters read from SU200. The format differs from the described format.

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Appendix B DIP switches

Switch 1:Future use.

Switch 1 has one valid setting, any other setting will disconnect the service port for parameterisation (–X9).

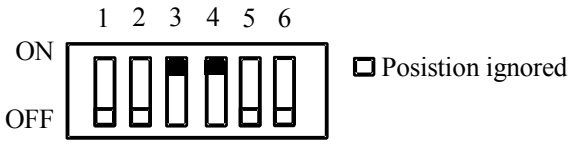


Figure 59 - DIP switch 1

Switch 2: Electrical configuration of RS485

The switch block selects type of termination.

Switches 2-5 and 2-6 are currently not in use.

Observe that proper function rely on switches to be set on or off as pairs. External termination requires both switches to be set off.

Switchsetting depends on RS485 line configuration.

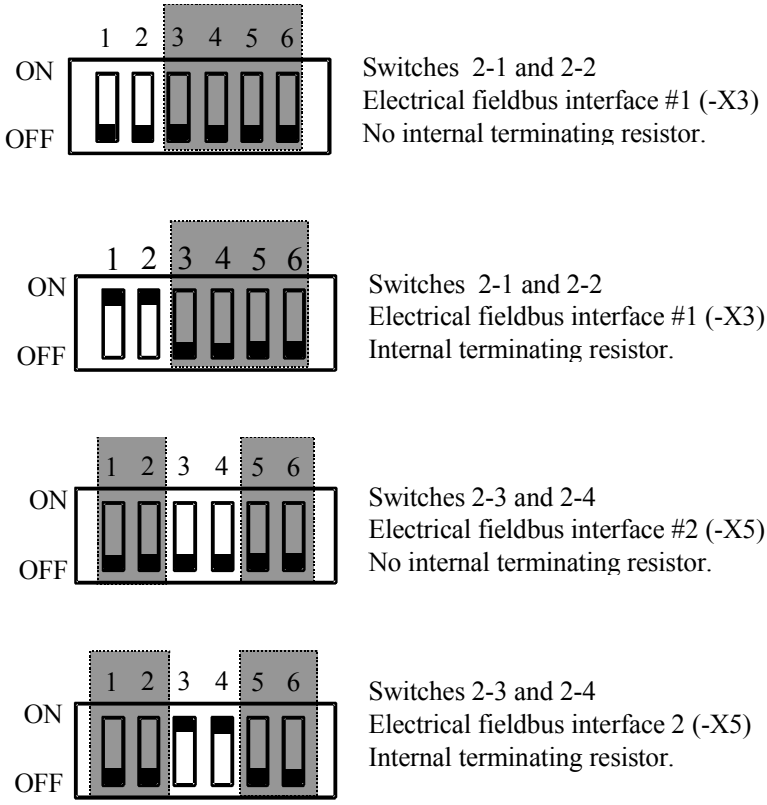
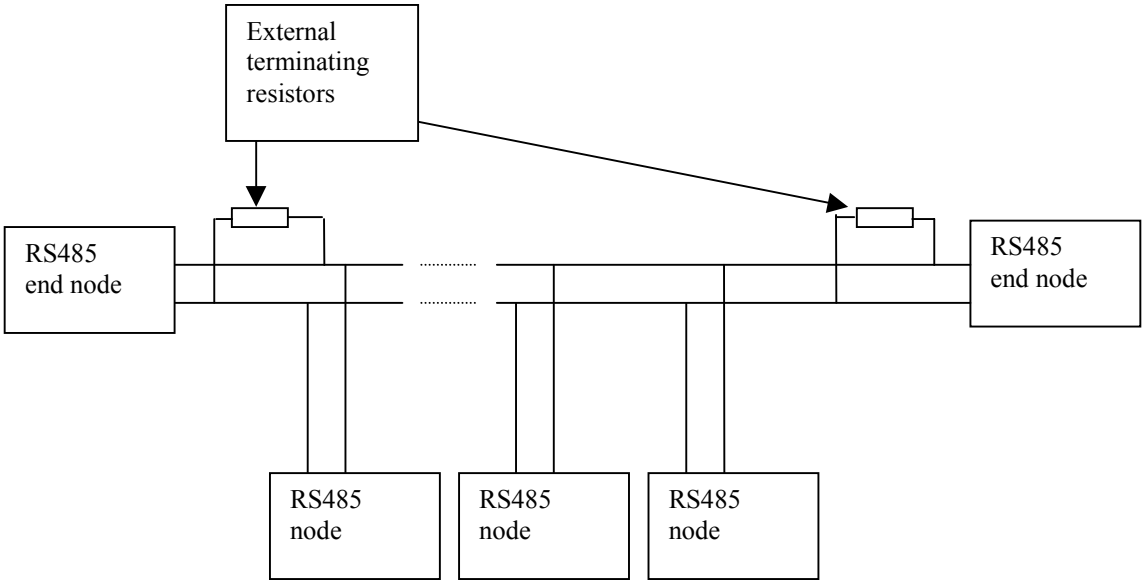


Figure 60 - DIP switch 2


External terminating resistors
RS485 end node
RS485 end node
RS485 node
RS485 node
RS485 node

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Appendix C PROFIBUS Test Tool

The PROFIBUS test tool allows a PC to be connected to one of the two PROFIBUS communication channels of SU200. The tool can be used for testing and demonstration of important features of SU200.

The PC must have a PROFIBUS master card installed. Currently two types of cards are supported:

- Siemens CP5613
- Siemens CP5412

The CP5613 card is operated with drivers for Windows NT, the CP5412 card has drivers for Win9X and Windows NT. Before the tool can be properly operated, a manual set-up of the PROFIBUS card is required, see appendix *C.1*.

Note that the installation of the PROFIBUS drivers and the COM PROFIBUS application requires an authentication disk (the drivers are copy-protected) as well as a SIMATIC NET CD.

Launching the PROFIBUS test tool will display the window as shown in *Figure 61*.

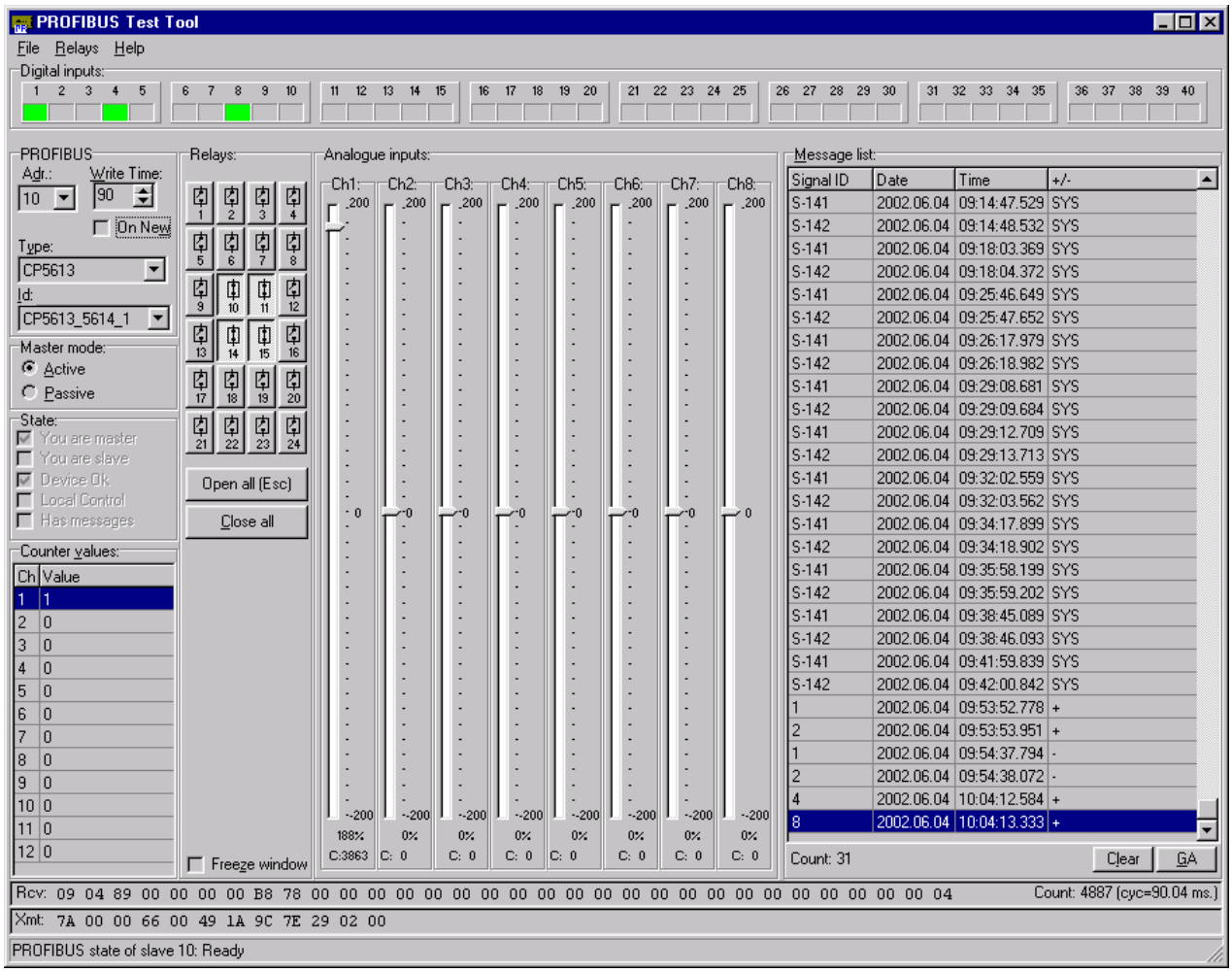

Figure 61 - PROFIBUS Test Tool

The following controls are displayed:

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Control	*Description*
Adr	Select the PROFIBUS address of the connected SU200
Type	Set type of PROFIBUS card in the PC. The card must be installed. A PROFIBUS network set-up should be created using COM PROFIBUS and loaded into the PROFIBUS card. See appendix *C.1*
Id	Access point for the PROFIBUS card. Unless there are more than one PROFIBUS card in the PC, the default value can be used. • For CP5412 cards, this control states the board number (1.4). • For CP5613 cards, the controls states the access point, e.g. CP5613_5614_1, where the last digit is the board number.
Write-Time	The PROFIBUS test tool does cyclic send telegrams to SU200 by the rate given by *Write-Time* (in ms.). The SU200 is operating as a DP slave and responds when new telegrams are received. If a high time-value is set, the data exchange is operated at a slow rate, allowing the user to visually inspect received and transmitted telegrams. The minimum value depends on the type of PROFIBUS card installed. For CP5613 cards, the min. value is 4 ms., while the min. value for CP5412 card is 10 ms. The actual cycle-time (measured time between every received telegram from SU200) is indicated in the status-bar.
On New	Check this checkbox to activate the fastest possible data exchange rate with SU200. The PROFIBUS test tool will transmit new telegrams to SU200 with the minimum *Write Time*. To increase the speed, a new telegram is sent immediately when the PC receives a new telegram from SU200 without respect to the set *WriteTime*.
Master mode	Select if the PROFIBUS test tool is active or passive master. Only an active master is allowed to: • Control relay outputs. • Acknowledging receipt of messages. • Initiating an interrogation of all possible messages (GA)
State	Indicates bit-coded information in telegrams received from SU200 , see *Figure 21*. • *You are master* indicates that the PROFIBUS test tool is operating as an active master. This checkbox is checked if an active master mode has been selected. However, if a second PROFIBUS test tool is running and also connected to SU200, both PROFIBUS masters will be set to passive master state in the case where they are both requesting to be the active master (only one interface can be the active master). • *You are slave* indicates that the PROFIBUS test tool is operating as a passive master. This checkbox is checked if passive master mode has been selected. • *Device OK* indicates that both power supplies and internal memory of SU200 are ok. See description of system message 144 in *Table 1* for a description of when the device is faulty. • *Local Control* indicates that a PC connected to the serial service channel controls the relay outputs of SU200. The PC is typically running the SU200DIA application with Local Control Mode activated, see chapter *6.3.1* • *Has messages* indicates that SU200 has messages which has not yet been acknowledged by an active master stored in it's message buffer.
Counter values	Displays up to 12 impulse counter values received from SU200. See chapter 6.3.3 for programming counters using SU200DIA. Note that only the counter values are displayed. The input channel ID's are not sent in the

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	telegram from SU200.
Relays	Buttons for individual control of all relay outputs. Buttons for closing or opening all relay outputs. This buttons can only be operated if active master has been selected and local control isn't active.
Freeze window	This button freezes all controls which are displaying data without actually stopping the communication. Typically used to inspect the current received/transmitted telegram.
Analogue inputs	Slider-bars indicating all the value of analogue input channels in the range ± 200%. The actual values in count is also displayed (± 4096).
Digital inputs	Displays the logical signal level of all digital inputs. The logical signal level is the physical signal level adjusted for selected logical level (positive/negative) and applied to the filter-time/dead-time filtering.
Message list	Displays all received messages with a one ms timestamp. The type of the message is displayed as well. SYS System message + Coming/raised alarm - Leaving alarm See *Table 1* for a list of system messages. The *Clear* button can be used to clear the message list.
GA	This button will send a general interrogation command to SU200. SU200 will responds with the status of all digital inputs including the program signal ID.
Rcv *Xmt*	Shows the last received/transmitted telegram. See chapter *4.5* for how to decode the telegrams.

Table 18 - PROFIBUS Test Tool controls

C.1. Setting up the PROFIBUS network

The PROFIBUS master cards need to be configured before the PROFIBUS test tool can be used.

A database that defines the network including the PROFIBUS master cards and the SU200 devices has to be created and selected.

The database has extension `ET2` and is normally stored in the `progdat` sub-directory of COM PROFIBUS. The `ET2` file is exported to a binary `LDB` file. The `LDB` file is normally stored in the `ncm` sub-directory of COM PROFIBUS.

After installation of the PROFIBUS test tool, two PROFIBUS network set-ups are available:

- SU541210 For CP5412 PROFIBUS master card and a single SU200 with PROFIBUS address 10
- SU561310 For CP5613 PROFIBUS master card and a single SU200 with PROFIBUS address 10

C.1.1. Setting up PROFIBUS master card CP5613

Install CP5613 card and it's software drivers. See external documentation.

Run program `SIMATIC NET→CP5613_CP5614→Diagnostics→InstallationCheck`. The window shown in *Figure 62* will be displayed. The window contains a *Test* button that can be used to test installation of the card as well as the software drivers.

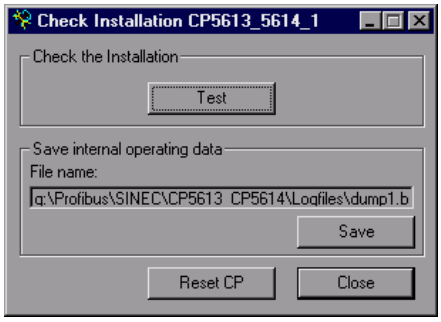

Figure 62 - Checking the CP5613 card installation

Run program `SIMATIC NET→CP5613_CP5614→DatabaseUsed`. The window shown in *Figure 63* will be displayed. The name of the database that contains the set-up of the PROFIBUS network must be specified (`SU561310.ldb`).

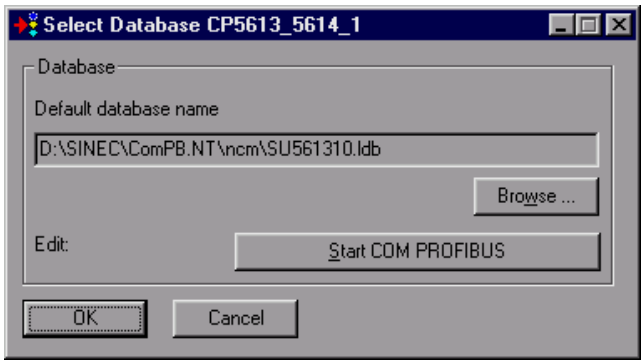

Figure 63 - Selecting database for CP5613

The CP5613 card should now be ready for use in the PROFIBUS test tool.

C.1.2. Setting up PROFIBUS master card CP5412

Install CP5412 card and it's software drivers. See external documentation.

Click this icon in the Control Panel:

Select the access point `CP_L2_1`, This access-point must be assigned to `CP5412A2(PROFIBUS)`. First select `CP_L2_1` in the upper list control, then select `CP5412A2` in the lower list-control.

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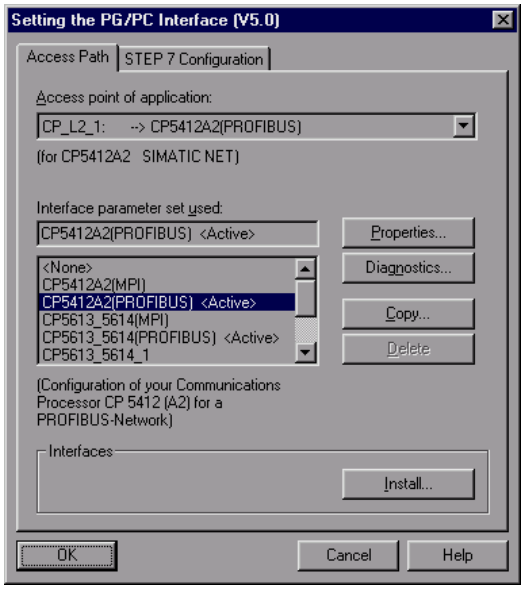

Figure 64 - Setting the CP5412 access point

Press the *Properties* button to the display the window shown in *Figure 65*.

Check the *Active DP checkbox* and select the name of the database that contains the set-up of the PROFIBUS network. As described earlier, a default set-up file named `SU541210.LDB` is available after installing the PROFIBUS test tool.

The window shown in *Figure 66* can be used to restart the CP5412 card. This restart may be necessary if the PROFIBUS test tool is not properly shutdown. The card can not be restarted while the PROFIBUS Test Tool is running.

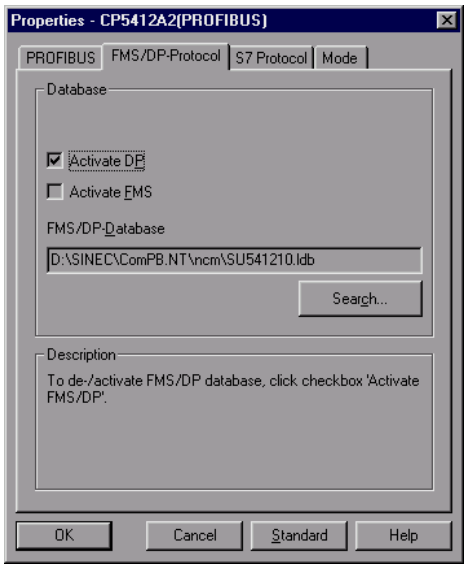

Figure 65 - Selecting database for CP5412

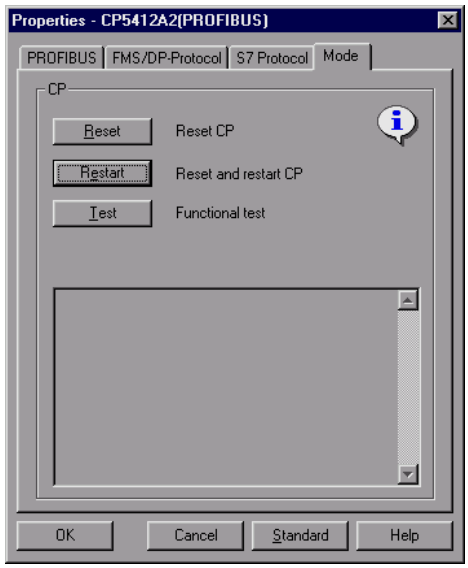

Figure 66 - Restarting CP5412

C.2. Configuring and using the COM PROFIBUS application from Siemens AG

COM PROFIBUS is a SIMATIC NET application from Siemens AG used to create and maintain a set-up of

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a PROFIBUS network.

After installation of the PROFIBUS test tool, two PROFIBUS network set-ups are available:

- SU541210 For CP5412 PROFIBUS master card and a single SU200 with PROFIBUS address 10
- SU561310 For CP5613 PROFIBUS master card and a single SU200 with PROFIBUS address 10

The COM PROFIBUS application does not need to be operated unless another set-up is required.

C.2.1. SU200 GSD file

Every PROFIBUS station type has a `GSD` file that describes network-related properties of the station.

The name of the `GSD`-file for SU200 is `SU200.GSE` (E=English). This file is installed into the `gsd` directory of the COM PROFIBUS application. The `GSD` file refers to a bitmap file used to display an icon of the SU200 in COM PROFIBUS. The bitmap is named `SU200__n.bmp` and is installed in the `bitmaps` directory of the COM PROFIBUS.

When COM PROFIBUS is used for the first time after installation of the PROFIBUS Test Tool, the `GSD` file for SU200 must be imported into the COM PROFIBUS station type list.

Run menu-command `File→Scan GSD files`. Verify that the SU200 `GSD` file has been correctly imported using menu command `Documentation→Station Types/GSD Files`. SU200 should be found in the list of installed `GSD` files (in group "`OTHER`"). See *Figure 67*.

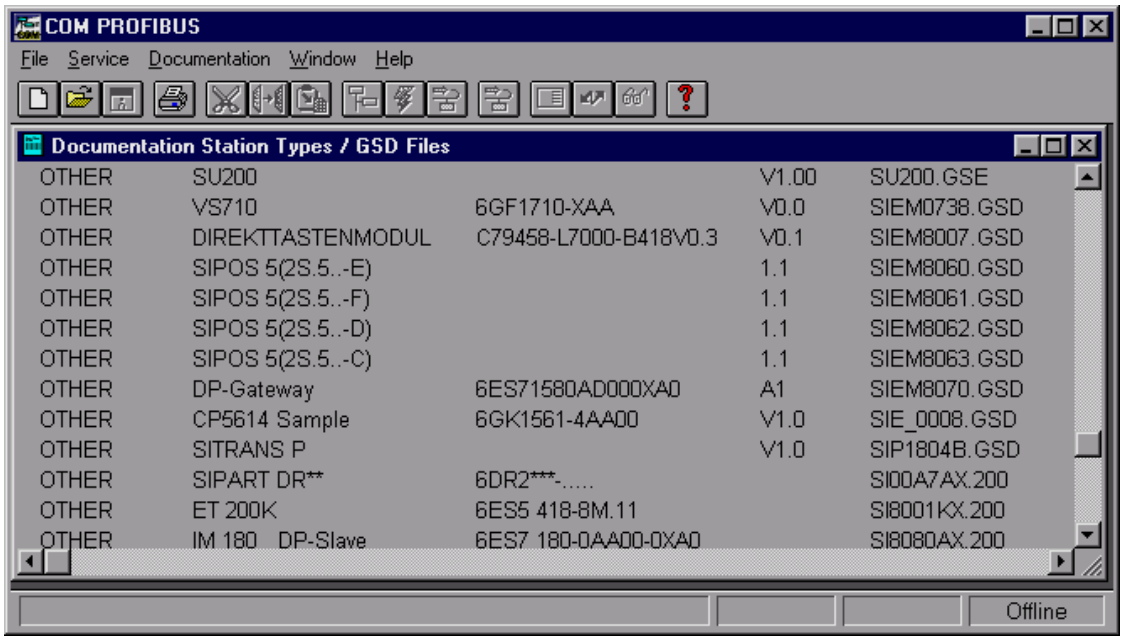
COM PROFIBUS
File Service Documentation Window Help
Documentation Station Types / GSD Files
OTHER SU200 V1.00 SU200.GSE
OTHER VS710 6GF1710-XAA V0.0 SIEM0738.GSD
OTHER DIREKTTASTENMODUL C79458-L7000-B418V0.3 V0.1 SIEM8007.GSD
OTHER SIPOS 5(2S.5..-E) 1.1 SIEM8060.GSD
OTHER SIPOS 5(2S.5..-F) 1.1 SIEM8061.GSD
OTHER SIPOS 5(2S.5..-D) 1.1 SIEM8062.GSD
OTHER SIPOS 5(2S.5..-C) 1.1 SIEM8063.GSD
OTHER DP-Gateway 6ES71580AD000XA0 A1 SIEM8070.GSD
OTHER CP5614 Sample 6GK1561-4AA00 V1.0 SIE_0008.GSD
OTHER SITRANS P V1.0 SIP1804B.GSD
OTHER SIPART DR** 6DR2***-..... SI00A7AX.200
OTHER ET 200K 6ES5 418-8M.11 SI8001KX.200
OTHER IM 180 DP-Slave 6ES7 180-0AA00-0XA0 SI8080AX.200
Offline

Figure 67 - COM PROFIBUS station types

C.2.2. Creating a PROFIBUS network set-up for SU200

Start the COM PROFIBUS network set-up.

Open the `SU561310.ET2` file for maintaining the network set-up if the PC has a CP5613 card installed.
Open the `SU541210.ET2` file for maintaining the network set-up if the PC has a CP5412 card installed.

Press enter in the initial window displaying PROFIBUS master information and the window with the actual set-up will be displayed, see *Figure 68*.

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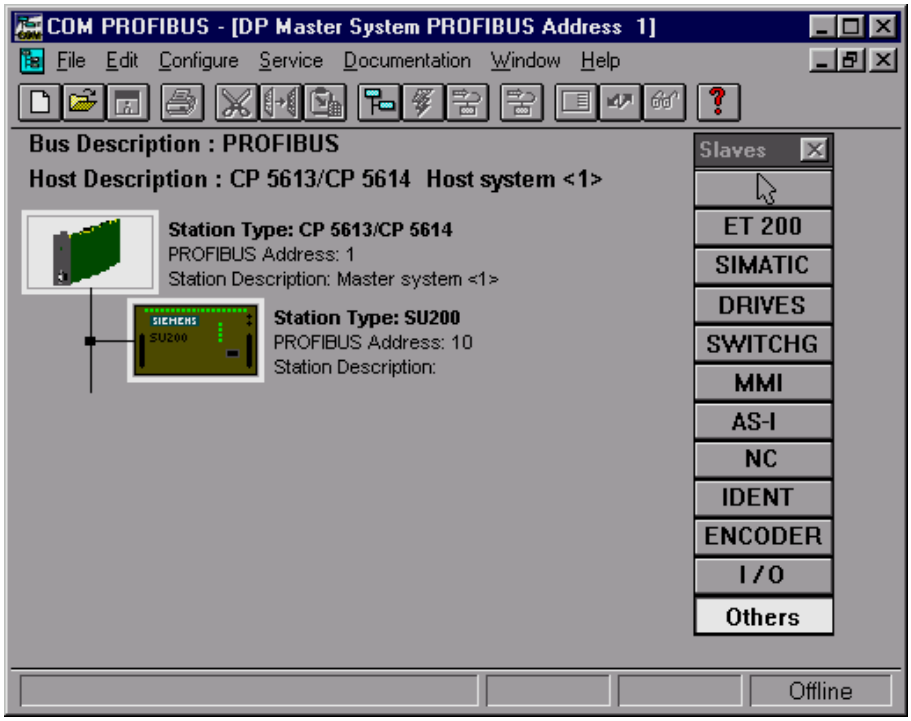

Figure 68 - COM PROFIBUS network set-up

More SU200 stations can be added to the network set-up by

1. Clicking the *Others* button
2. Selecting an PROFIBUS address
3. Selecting SU200 in the shown list

Delete a SU200 from the network set-up by selecting its icon and clicking the delete key.

Change the bus speed (up to 1500 kBaud) by menu command *Bus parameters*. The window shown in *Figure 69* will be displayed.

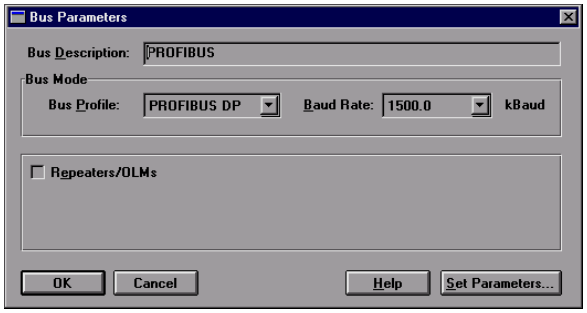

Figure 69 - Setting PROFIBUS network speed

After the network set-up has been saved back to the `ET2` file, it must be exported to the `LDB` file, which is used by the PROFIBUS card's driver (see *Figure 63* for how to select this file for the CP5613 card).

Export the network set-up using menu command `File→Export→NCM File`. Select the name of the `LDB` file as shown in *Figure 70*.

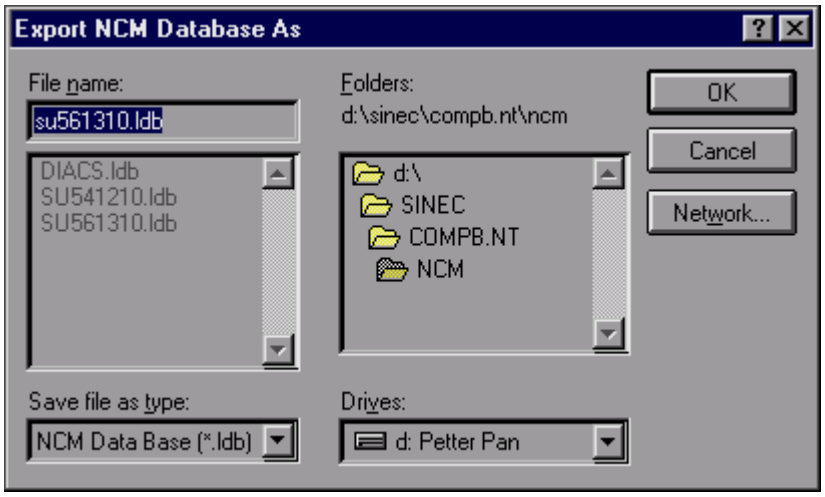

Figure 70 - Exporting COM PROFIBUS network set-up to a LDB file

The CP5613 card will use the new PROFIBUS network set-up immediately (the PROFIBUS Test Tool must be closed and started again).

The CP5412 card will not use the new PROFIBUS network set-up before the card is restarted. Re-boot the PC or operate the window shown in *Figure 66.*

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Appendix D Replacing FLASH memory devices

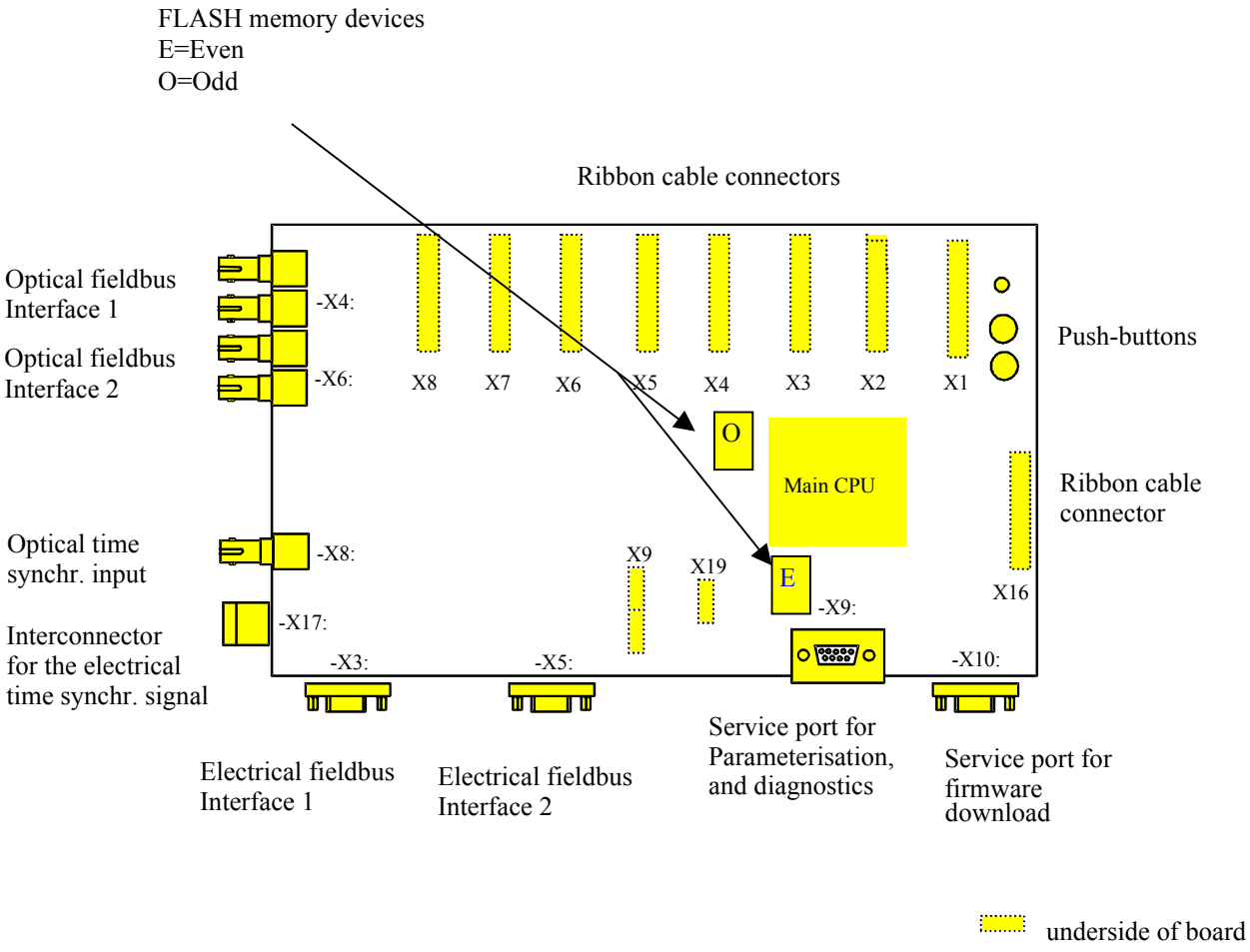
Two IC's must be replaced on the CPU card, see drawing. The drawing shows the CPU card seen from the topside (not the component view).

Both IC's are in sockets and located just around the main processor marked SAF-C167.

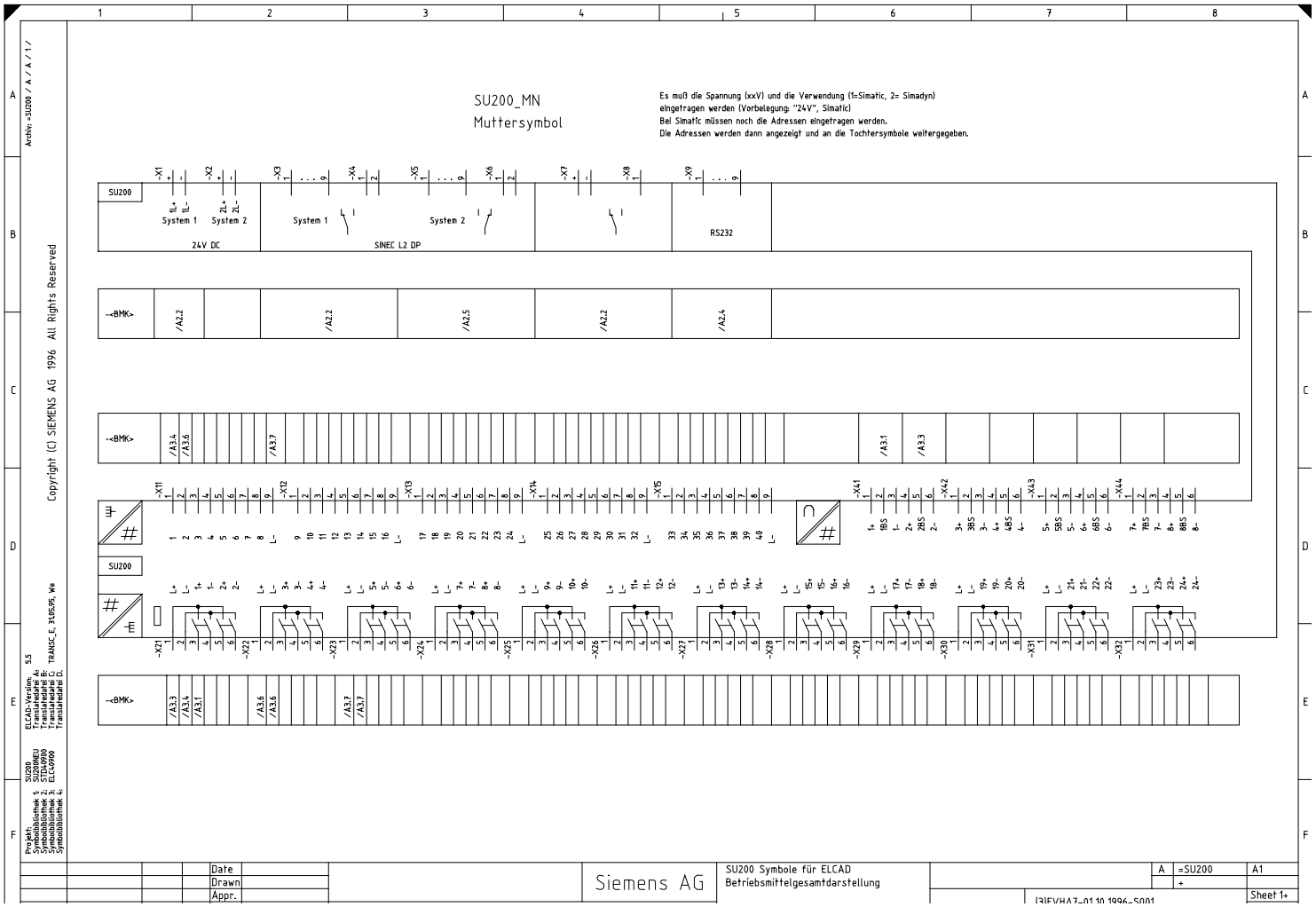
Note: There is actually two other FLASH memories on the CPU-card, this devices are used for the communication sub-system.

One of the FLASH devices are used for "even" addresses, the other for "odd" addresses, check label on replacement FLASH devices.

Check the replacement by e.g. powering-up SU200 and performing a lamp-test.



Appendix E General Terminal Diagram



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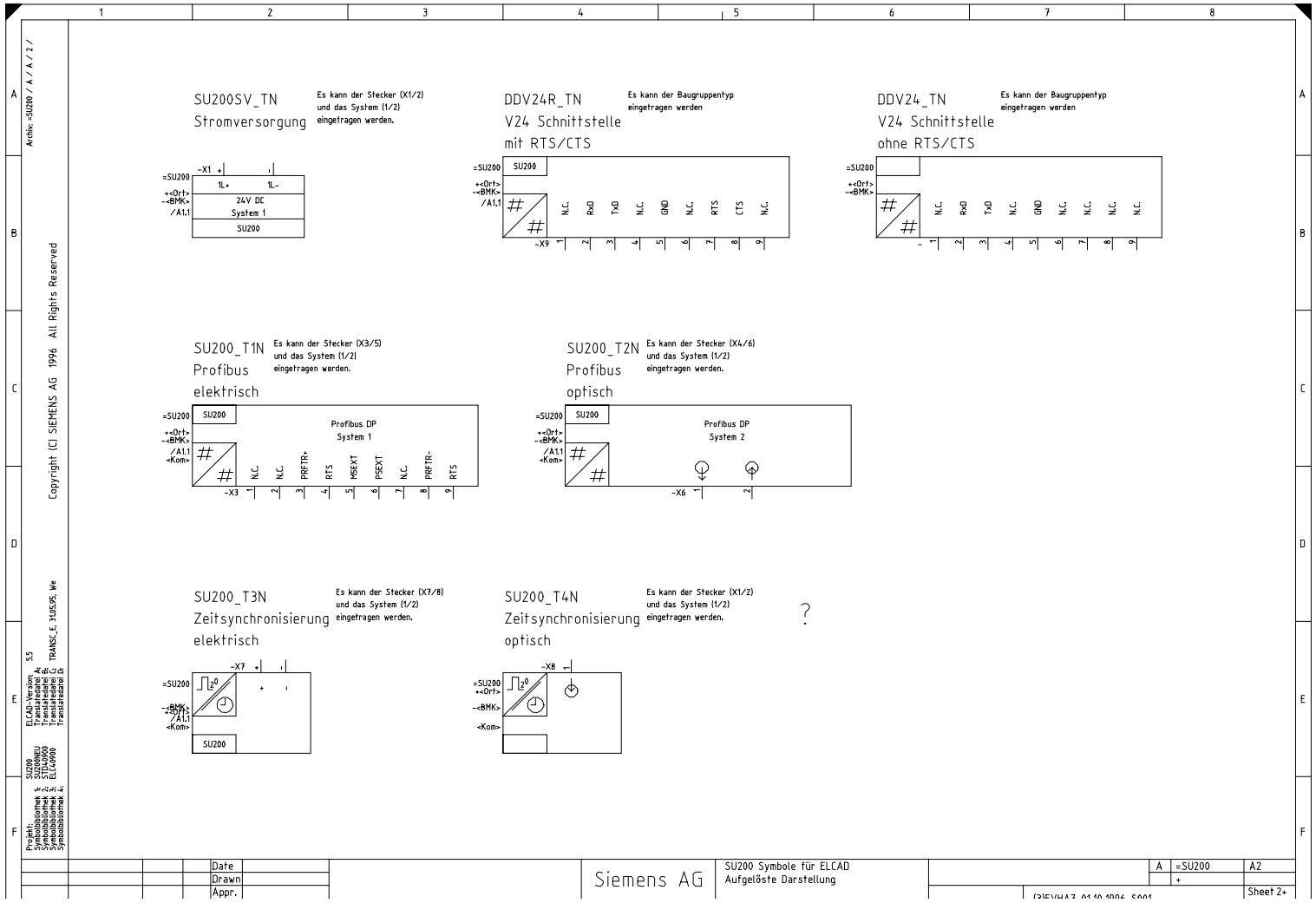
Appendix F Connection diagram for power supply / communications



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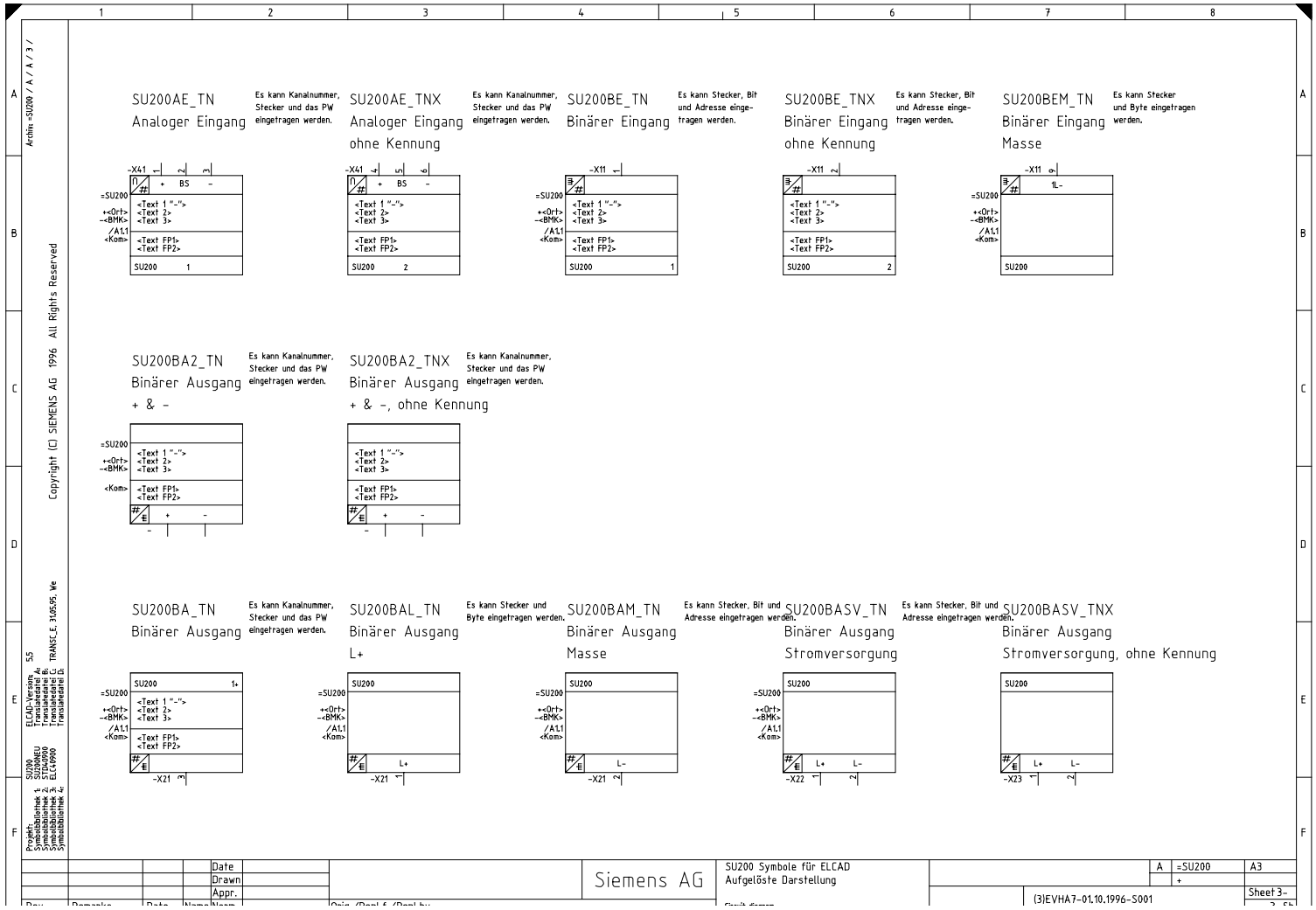
Appendix G Connection diagram for I/O


SU200AE_TN
Analoger Eingang
Es kann Kanalnummer, Stecker und das PW eingetragen werden.
SU200AE_TNX
Analoger Eingang ohne Kennung
Es kann Kanalnummer, Stecker und das PW eingetragen werden.
SU200BE_TN
Binärer Eingang
Es kann Stecker, Bit und Adresse eingetragen werden.
SU200BE_TNX
Binärer Eingang ohne Kennung
Es kann Stecker, Bit und Adresse eingetragen werden.
SU200BEM_TN
Binärer Eingang Masse
Es kann Stecker und Byte eingetragen werden.
SU200BA2_TN
Binärer Ausgang + & -
Es kann Kanalnummer, Stecker und das PW eingetragen werden.
SU200BA2_TNX
Binärer Ausgang + & -, ohne Kennung
Es kann Kanalnummer, Stecker und das PW eingetragen werden.
SU200BA_TN
Binärer Ausgang
Es kann Kanalnummer, Stecker und das PW eingetragen werden.
SU200BAL_TN
Binärer Ausgang L+
Es kann Stecker und Byte eingetragen werden.
SU200BAM_TN
Binärer Ausgang Masse
Es kann Stecker, Bit und Adresse eingetragen werden.
SU200BASV_TN
Binärer Ausgang Stromversorgung
Es kann Stecker, Bit und Adresse eingetragen werden.
SU200BASV_TNX
Binärer Ausgang Stromversorgung, ohne Kennung
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